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THESIS

SPECIALIZED COMMON CARRIERS: LONG DISTANCE ALTERNATIVES FOR MILITARY INSTALLATIONS

by

Scott L. Klingler

March 1984

Thesis Advisor: Dan C. Boger

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Specialized Common Carriers: Long Distance Alternatives for Military Installations

by

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requirements for the degree of

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ABSTRACT

Specialized Common Carriers, communications carriers which came into existence offering private line microwave service, are now significant competitors in the long distance telecommunications industry. This thesis provides military installation telecommunications managers with a basic knowledge of how Specialized Common Carriers entered the telecommunications market, what services Specialized Common Carriers offer, and how to obtain these services for a military installation. It includes a case study evaluation of the potential use of long distance services of two of these competing common carriers at Naval Air Station Moffett Field, California. A computer program used to calculate the costs of using these two alternative long distance carriers is included as part of the case study.

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I. INTRODUCTION

This thesis addresses Specialized Common Carriers (SCCs), those communications carriers which entered the market offering special communications services not adequately being provided by existing common carriers.[1] Initially, the special services offered by SCCs were primarily point-to-point private line microwave links for data or other customm transmission needs, but today SCCs are competing in markets that have historically been open only to the large domestic carriers such as American Telephone and Telegraph (AT&T) and Western Union. Today SCCs are succeeding, not in the private line market in which they started, but in the long distance, switched network services market in direct competition with AT&T. In fact, the offerings of SCCs today are so "un"-special that some authors refer to these carriers as **Other** Common Carriers (as in **other** than AT&T). This thesis will refer to these carriers as Specialized Common Carriers, the name attached to them when they first entered the market.

Before the advent of SCCs the base telecommunications manager[2] would rely heavily on the local telephone company representative to fill any long distance telephone needs since: 1) no other companies were in a position to offer service; and 2) the telephone company representative was glad to do it. Today, amidst fierce competition in the long

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[1]Some other classes of common carriers are Community Antenna Television (CATV), packet switching networks or Value Added Networks (VANs), mobile radio-telephone, marine radio-telephone, radio paging, domestic, and international carriers.

[2]The term "base telecommunications manager" is used throughout this thesis to refer to telecommunications managers at all types of military installations whether bases, posts, stations, or whatever.

distance market, the base telecommunications manager must recognize that this attitude is no longer economically sound. The purpose of this thesis is to assist base telecommunications managers in understanding how SCCs came into existence, what long distance switched voice network services SCCs offer, how to evaluate the potential use of SCC services at their installations, and how to begin the process to procure these services.

This thesis is organized as follows: Chapter II discusses the major events leading up to and following the Federal Communications Commission (FCC) ruling which authorized SCCs to openly compete in the private line microwave field.[3] Chapter III gives information on the services offered by SCCs and compares these services to those offered by AT&T. This chapter also discusses competitive procurement of SCC services and the current use of SCC services at various military installations and Department of Defense activities. Chapter IV is a case study analysis of a specific military installation (Naval Air Station Moffett Field, California) for the potential use of SCC long distance telephone services instead of or in addition to AT&T services. A computer program which calculates the costs of using services of two of these alternative long distance carriers is included as part of the case study. Chapter V summarizes the thesis.

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[3]Appendix A contains a chronology of major events affecting Specialized Common Carriers.

II. SPECIALIZED COMMON CARRIERS--A HISTORY

A. THE LONG DISTANCE MONOPOLY

Since Alexander Graham Bell's patent was issued in 1876, the Bell Telephone Company and the American Telephone and Telegraph Company (AT&T) have had a nearly continuous monopoly on providing local and long distance telephone service in the United States.[4] Setting aside the arguments whether the telephone industry was a natural monopoly[5] in the beginning, except during a few years between 1894 and 1907, and from 1968 until today, an approved monopoly it was.

The first period of exception to the monopoly was caused by the expiration of the Bell patent in 1894. As a result of the ensuing competition, the independent telephone companies owned 44 percent of all telephones by 1902 and 51 percent by 1907 [Ref. 4]. The period ended with the recall of Theodore Vail as the president of AT&T as he changed the company's policy from one of meeting competition to one of buying (or forcing) competitors out of the market.

In 1910 the Interstate Commerce Commission was given regulatory authority over the telephone industry, but it was not until the passage of the Communications Act of 1934 and the formation of the Federal Communications Commission (FCC)

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[4]The Bell Telephone Company was formed from the Bell Patent Association in 1877 and the American Telephone and Telegraph Company was formed in 1885 by the Bell Telephone Company to operate its long distance system. For an in depth review of the telephone industry's history see references 1, 2, and 3.

[5]A natural monopoly is an economic concept based on the principle that in certain industries one company can provide services more economically and efficiently than several companies in a competitive environment. Reference 5 is an excellent reference on this subject.

that the telephone industry was subject to any real regulation.[6]

The period of FCC regulation is very significant in the history of Specialized Common Carriers and is discussed in the following sections of this chapter.

B. THE ABOVE 890 AND CARTERFONE DECISIONS

Three FCC actions considered as landmarks in preparing the way for new entrants into the common carrier private line microwave field are the 1959 and 1960 FCC rulings commonly referred to as the **Above 890** decisions and the 1968 FCC ruling dubbed the **Carterfone** decision.

1. Above 890 Decisions

Microwave radio, an outgrowth of the invention of the klystron tube by Bell Laboratories and the M.I.T. Instrumentation Lab, was developed during World War II for radar applications. It was modified and began being used as a transmission medium for point-to-point communications because of its increased capacity, better quality, and higher reliability over wire or cable transmission systems. Shortly after World War II, Western Union built a microwave system connecting New York City and Philadelphia as an experiment to see if it was suitable for use as a common carrier system **[Ref. 6]**. By 1956 microwave transmission accounted for 22 percent of the 10.5 million circuit miles of the telephone system **[Ref. 7]**.

The 1959 and 1960 FCC **Above 890** decisions opened the microwave field to private firms and individuals allowing them to install microwave systems utilizing the frequency

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[6]Even with the FCC regulating the telephone industry there is some question as to who regulated whom between the FCC and AT&T. In the FCC's first twenty-five years of existence there was no regulation which significantly decreased AT&T's monopolistic position.

spectrum above 890 MHz for their own use. While this decision did not authorize new companies to compete with established common carriers, it was certainly a step in that direction. Since the FCC prohibited sharing facilities and systems, only companies or users needing a large volume of circuits between two points were economically able to take advantage of building their own systems instead of leasing from the common carriers.

The **Above 890** decisions were not the result of petitions of companies seeking entrance into the microwave carrier market, as one would expect, but instead were the result of the persistence of microwave equipment manufacturers and potential users of private microwave links [Ref. 8].

The proceedings which led to the **Above 890** decisions began in 1956 with an FCC review of microwave frequency allocations which included a look at letting private users construct their own microwave systems when common carrier facilities were already available. The idea of private microwave systems was not a new one[7] for there were already tens of thousands of route miles of microwave systems in existence to serve railroads, mining operations, pipelines, and other right-of-way companies at the time of the Above 890 proceedings. [Ref. 7] However, the prevailing FCC policy was to grant microwave licenses only to common carriers and right-of-way companies due to a perceived shortage of frequencies available to allocate.

The opposition by established common carriers (specifically AT&T, Western Union, and the independent telephone companies) was fierce. Their arguments against permitting private concerns to build their own microwave

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[7]The first application for a private microwave system was submitted in 1948 by a railroad company as an experiment to compare the service and cost of their own system with the circuits they were leasing from common carriers [Ref. 6].

systems were based on claims that the frequency spectrum was limited and that the FCC had a responsibility to protect the economic interests of the established common carriers by prohibiting competition. They also argued that licenses for private microwave facilities should be given only when common carrier services were unavailable and should be revoked when common carrier facilities became available. [Ref. 7] Furthermore:

> The Bell System witnesses contended that to permit the licensing of private systems where common carrier facilities are available would cause irreparable harm to the telephone company's ability to provide a basic nationwide communications service, which is vital in times of peace but indispensable in times of national emergency. Also, they claimed that widespread licensing of private systems would not only increase the cost of communications to the Nation's economy as a whole but would cast an added burden upon the individual and the small businessman who would continue to rely on common carriers. [Ref. 9]

The arguments of AT&T and the others failed, because, "...the fact remained, the private applicants pointed out, that if permitted to construct their own facilities, they would provide for their needs at much lower costs than the carrier tariffs" [Ref. 10]. The FCC made their decision in July 1959 concluding: "...there are now available adequate frequencies above 890 Mc[8] to take care of the present and reasonably forseeable future needs of both the common carriers and private users for point-to-point communications systems" [Ref. 11].

Not ready to give in without a fight, the common carriers asked the FCC to take another look at the frequency spectrum question stating that with communications satellites coming into existence the FCC should wait until it was certain the satellite systems would not need the frequencies

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[8]The units of frequency measurement were changed from cycles to Hertz after these decisions.

above 890 MHz. The FCC reaffirmed their original decision in 1960.

2. Carterfone Decision

From its beginning, AT&T had a policy of refusing interconnection with anyone and everyone. This was their way of ensuring their monopoly status. However, this stand was changed when antitrust litigation in 1913 forced AT&T to promise to allow independent telephone companies to interconnect with the AT&T long distance network.[9] Connection of equipment or attachments by customers was quite another matter--they were strictly prohibited by AT&T. In fact, AT&T maintained they had the right to remove the equipment or stop service to the customer. [Ref. 12 , 13]

In 1921 the Hush-A-Phone Corporation began manufacturing a simple non-electronic device to place over the telephone mouthpiece to prevent room noises from being picked up, as well as to provide some privacy for the telephone user so his/her conversation would not be heard by others in the room. AT&T sought prohibition of use of the device. In 1955 the FCC weakened the AT&T interconnection position by ruling:

> The provisions ...shall not be construed or applied to bar a customer from using devices which serve his convenience in his use of the facilities of the Telephone Company ...provided any such device so used would not endanger the safety of Telephone Company employees or the public; damage, require change in or alteration of, or involve direct electrical connection to the equipment or other facilities of the Telephone Company; or interfere with the proper functioning of such equipment or facilities; or impair the operation of the telephone system or otherwise injure the public in its use of the Telephone Company's services. [Ref. 14]

---

[9]This promise is known as the "Kingsbury Commitment," named after N.C. Kingsbury, then Vice-President of AT&T.

In spite of this decision, AT&T still generally refused interconnection.

AT&T next took on the Carter Electronics Corporation when they began marketing the Carterfone, a device which acoustically coupled a mobile radio system with the telephone system through the telephone handset.[10] AT&T insisted that they "must control every element of the [telephone] system" to insure that it works best for all. In the 1968 **Carterfone** decision the FCC concluded:

> ...a customer desiring to use an interconnecting device to improve the utility to him of both the telephone system and a private radio system should be able to do so, as long as the interconnection does not adversely affect the telephone company's operations or the telephone system's utility for others [Ref. 14].

The **Carterfone** decision, that the Bell System had to permit interconnection of non-Bell equipment as long as the interconnection would not harm the system or disrupt the ability of others to use the system, was important since it would allow for the future interconnection of Specialized Common Carrier (SCC) switching equipment.

C. MCI DECISON

The development of computers and their widespread acceptance and use in the 1960s created a need for data communications that was essentially unavailable from the established common carriers. The AT&T and Western Union systems were designed using analog technology primarily intended for voice transmission not data. In 1963, Microwave Communications, Incorporated (MCI) applied for FCC certification for public common carrier point-to-point microwave communications service between Chicago and St Louis and intermediate

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[10]This was an accustical modem arrangement, but instead of transmitting data it coupled voice signals.

points. MCI's proposal was to provide simply a microwave link between the two locations. The subscribers would be required to provide their own terminal equipment and connections with the MCI system.

AT&T, General Telephone, Illinois Bell, Southwestern Bell, and Western Union opposed the application (as would be expected) contending that:

> ...the service would meet no demonstrated need, that it would result in wasteful duplication of facilities, that MCI did not posess the legal, technical, and financial qualifications to install and operate the system, and that the system would cause radio interference to existing and future facilities of the established common carriers [Ref. 15].

Besides these arguments, they contended that it was a waste of the FCC's time to consider the application since MCI would not be able to provide local service (since this industry was already monopolized) and existing carriers would refuse to provide interconnection [Ref. 15].

Probably more as an experiment than any other reason, the FCC approved the MCI application in 1969 in what is called the **MCI** decision. Kahn explains the basis for the approval thusly:

> MCI offered two things that the Bell companies and Western [Union] did not: first, low rates - its proposed charges were less than half those of the established carriers - and second, far greater freedom and flexibility in use of the service: customers could attach such equipment as they saw fit and up to five of them could share the use of a single channel, thus further reducing the cost of each. And it was this proposed contribution that, in the last analysis, induced the FCC to approve the application. [Ref. 16]

D. SPECIALIZED COMMON CARRIER DECISION

Following the MCI decision new entrants were jumping on the private line microwave system bandwagon in spite of the FCC statement that their decision would not be considered as a binding precedent for future applications. By 1971 there were applications on file with the FCC for 1,977 microwave stations in 46 separate proposals from 33 new carriers. [Ref. 17] The FCC was not particularly interested in reviewing each of these applications individually and therefore set out to establish a ruling applicable to all of them. The resulting June 1971 ruling, the **Specialized Common Carrier** decision, opened the SCC field to open competition. The FCC said:

> We find that: there is a public need and demand for the proposed facilities and services and for new and diverse sources of supply, competition in the specialized communications field is reasonably feasible, there are grounds for a reasonable expectation that new entry will have some beneficial effects, and there is no reason to anticipate that new entry would have any adverse impact on service to the public by existing carriers such as to outweigh the considerations supporting new entry. We further find and conclude that a general policy in favor of the entry of new carriers in the specialized communications field would serve the public interest, convenience, and necessity. [Ref. 18]

E. AFTER THE SPECIALIZED COMMON CARRIER DECISION

As with the preceding decisions, the **Specialized Common Carrier** decision met with strong opposition from the existing common carriers. In addition to asking the FCC to reconsider its decision based on the arguments previously used while fighting the MCI decision, the existing common carriers refused to interconnect the SCCs through the local telephone exchanges knowing that, if it were difficult for potential users to access the SCC systems, the SCC market

would be restricted. The FCC had upheld that AT&T and the others must provide interconnection from the beginning, but the regulatory and legal processes precluded full interconnection rights to the SCCs for five years after the **Specialized Common Carrier** decision. [Ref. 19]

During this period MCI continued to create difficulties for the established common carriers by introducing its Execunet service. Touted as a "shared" private line service, Execunet very closely resembled the long distance voice service offered by AT&T with the exception that Execunet had only a very small number of cities in its network. Instead of leasing a private line full-time for a monthly rate, Execunet subscribers could dial into the system when required and be charged on a time and mileage basis, with connect and monthly minimum charges. Thus users that could not afford a full-time private line could afford this "shared" private line.

AT&T quickly asked the FCC to bar MCI from offering Execunet since it was obviously (obvious to AT&T with their long distance switched network monopoly) not authorized by the **Specialized Common Carrier** decision. The FCC did order MCI to discontinue Execunet, but their action was later reversed by an appeals court.

1. Switched Voice Networks: The SCC's Money Maker

While SCCs continue to offer private line point-to-point service, which is what the FCC **Specialized Common Carrier** decision originally permitted them to provide, their "bread and butter" business is now their switched voice network offerings. Revenues in 1983 from the long distance services provided by MCI, GTE Sprint, and ITT United States Transmission Systems (USTS) totaled $2.44 billion. (See Table I.) While only seven percent of AT&T's $35 billion,

TABLE I

1983 Long Distance Service Revenues

	Revenues (millions)	Profits (millions)	Subscribers (thousands)
AT&T	$35,000	$1,430	85,000
MCI	$ 1,520	$ 203	1,550
GTE Sprint	$ 750	$ 66	920
ITT	$ 170	$ 8	95

this market is exhibiting exceedingly rapid growth.[11] [Ref. 20] Analysts predict that this may increase to 10 to 20 percent of a more than $100 billion per year industry by 1990 [Ref. 21].

When the SCCs started up, the number of cities to which they offered services was very small and all (or nearly all) were large metropolitan areas. Today MCI, GTE Sprint, ITT, and other SCCs have networks that extend from coast to coast. MCI's system, begun as a single microwave system between St Louis and Chicago, has evolved into a nationwide network connecting thousands of cities in hundreds of metropolitan areas. (See Appendix C for a listing of all the area codes and prefixes currently on the MCI network.)

In spite of the success that the SCCs have had in getting favorable regulations and establishing a position in the common carrier market, they are still faced with problems. They may have nearly overcome the regulatory problems

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[11]In 1980 MCI, Southern Pacific Communications (now GTE Sprint), ITT USTS, and Western Union had $400 million in revenues (only two percent of AT&T's $20 billion in the same year). In 1975, these companies had only $30 million in revenues. [Ref. 21]

(particularly since AT&T has lcst control of its operating companies[12] and is primarily in the competitive lcng distance or long-lines business) but there are technical problems that must be resolved.

The first technical problem is that dual tcne multi-frequency (DTMF) signalling[13] is required tc access the SCC's network. If a pctential customer is among the majority that own rotary or pulse dial telephone instruments the potential customer is currently not able to use the SCCs' lcng distance networks. This is a serious disadvantage to the SCCs since they are trying to reach as much cf the lcng distance telephone market as possible. Next, to make calls cn the SCC's netwcrk requires dialing[14] twelve or more extra digits (besides the ten digit number of the party to be called): a seven digit telephone number to access the SCC switch (the local access number), then a five or mcre digit accounting code. Third, the SCC's systems have been known tc recognize ncise on the line as a completed call[15] so that a customer cculd be billed for calls that actually never went through [Ref. 26].

The first twc problems can be eliminated thrcugh the use cf dedicated access lines (DALs)[16] or least cost routing

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[12]References 22, 23, 24, and 2 are good references which discuss the AT&T divestiture. Reference 25 deals with the impact cf the AT&T divestiture on telecommunicatcns services to the Department cf Defense, but, in this author's cpinicr, it is neither objective nor current.

[13]Touch tone is the Bell registered trademark for this type cf signalling.

[14]Even with DTMF signalling the process of inputting a telephone number is called "dialing" although no dialing is actually dcne.

[15]This is due to the fact that the SCCs are not able to directly ccnnect to the local telephone exchange to receive call ccmpletion signals and must rely on their ccmputers recognizing a change in the ringing pattern.

[16]A dedicated access line (DAL) is basically a tie line to the SCC switch which eliminates the need to dial the local access number cr an authorization code to make a call cn the SCC network.

devices (available for a monthly fee from MCI and GTE Sprint), but these solutions are not for the small user since the money saved by using the SCCs services would not compensate for the cost of the DAL or least cost routing device. The SCCs will be remedying these problems for even the small user beginning in the fall of 1984 as a result of AT&T's divestiture of its operating companies. After the divestiture, MCI and the others will be able to connect directly to the local telephone exchange for access[17] as well as for recording billing information. A glimpse of the coming changes was seen in 1981 when the Northwest Iowa Telephone Company, one of the nearly 1,500 independent telephone companies in the United States, offered MCI service to all of its customers. Now their customers can dial "6" (using rotary or pulse dial, or touch tone telephones) to make long distance calls via MCI's circuits, just as dialing "1" accesses the AT&T long distance system. [Ref. 27 , 28] Other digits for access or billing codes are unnecessary since these functions are done electronically by the telephone company's central office equipment.

Another major disadvantage of using SCC services was that the user could complete calls only to other cities within the SCCs network (assuming the user was in a city served by an SCC; this is still the major problem of using SCCs services). An FCC ruling in 1980 permitting the resale of Wide Area Telecommunications Service (WATS) changed all that.[18] Now SCCs offer the capability to place calls to

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[17]"Equal access" is the term being given to this issue--where all carriers are to receive "equal access" to the long distance market. Starting in September 1984 local companies must begin offering their telephone users the opportunity to choose the long distance carrier they want to give their business. One third of a local companies' access lines must enter the realm of "equal access" by September 1985 and the remainder by September 1986.

[18]Although not the subject of this paper, this ruling also led to the creation of "resellers"--those who lease circuits from common carriers and resell these circuits (or

anywhere in the continental United States but only from selected network cities. The rates are usually higher for calls to these non-network cities, but are still cheaper in most cases than the same call placed with AT&T.

2. Changes Taking Place

SCCs are still pressing forward regardless of problems. In 1980 an FCC study proclaimed that telephone competition is "speeding innovation and meeting unsatisfied communications needs" [Ref. 29]. Now that SCCs are confident they are not going to be regulated or dominated out of existence, they are making significant plans and changes to their offerings. Besides continuing to expand their networks, SCCs are installing fiber optic cables and using communications satellites for their networks. They are even investigating using cable television networks to provide local telephone service.[19] [Ref. 30]

What will the future bring? The FCC ruling in 1980 permitting the resale of WATS suggests the possibility of the formation of what Johnson describes as:

> ...'carrier's carriers,' whose express objective would be to build transmission facilities for use by other common carriers. ...While AT&T is itself a common carrier, one could imagine in the future a firm whose entire business consists of leasing facilities to other common carriers. [Ref. 31]

Perhaps this is in the future for one of the SCCs.

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use of the circuits in the case of switched type services) to customers.

[19]No doubt the SCCs will be going after the still monopolized local telephone service market if their test results are promising.

F. CONCLUSION

This chapter has presented a brief history of the SCCs from the invention of microwave radio to the use of fiber optic cables and communications satellites. Fortunately, the early FCC decisions on matters such as using microwave frequencies for private microwave systems (different from **private line**) and interconnection were favorable for SCCs. Even with the favorable regulations, it was a very risky undertaking for **very** small companies such as MCI to take on the corporate giants such as AT&T and its cohorts in the common carrier industry, for AT&T and the others were ready and able to fight for their previously well-protected monopoly.[20] But the SCCs survived the AT&T self-preservation tactics and have established themselves as small but rapidly growing competitors.

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[20]The chairman of the board of MCI later said it had cost MCI $10 million in legal and other regulatory costs in their effort to get their network approved--a high price to pay considering the total cost of their St Louis to Chicago microwave link was $2 million [Ref. 32]. Data Transmission Co. (DATRAN) paid an even higher price--they lost their struggle to compete and filed for bankruptcy only a couple of years after they began.

III. SPECIALIZED COMMON CARRIER SWITCHED VOICE NETWORK SERVICES

This chapter discusses the switched voice network offerings of AT&T, MCI, and GTE Sprint, and the use and procurement of SCC services within the Department of Defense.

A. AT&T'S SERVICES--THE MARKET STANDARD

The long distance telephone service that everyone is intimately familiar with is AT&T's Long Distance Message Telecommunications Service (LDMTS), or MTS for short. MTS is the composite service of direct distance dialing and operator assisted calling (person-to-person, collect, third number, etc.). With MTS a telephone user (who is willing to pay for it, of course) can place a call to anywhere in the world. AT&T's MTS is billed according to the duration of the call, the rate period (day of week and time of day)[21] in which the call was made, and the distance to the called number.[22]

Wide Area Telecommunications Service (WATS) is another AT&T service that most have come in contact with.[23] Some contend that WATS differs from MTS only by the method of billing. While it is true that WATS calls are routed over the same AT&T circuits as MTS calls, one major difference

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[21]In 1982 AT&T changed their method of considering the rate period in calculating the cost of a call. Previously, the entire call was billed according to the rate period of the first minute. Now calls are billed at the rate of the rate period in which each minute of the call occurs.

[22]This is referred to as usage sensitive pricing. It is also referred to as time and/or distance (or mileage) sensitive pricing.

[23]This discussion is about outward WATS. Inward WATS (800 service) is basically the same as outward WATS except the calling is inward.

exists. WATS calls may be originated only via a limited number of WATS trunks connected to the PBX.[24]

Interstate WATS is offered in the form of six geographical areas called Service Areas (formerly Bands). Service Area 1 includes the states adjacent to the state in which the call is originated and each higher numbered Service Area adds a larger geographical area to the lower numbered Service Area(s). Service Area 5 WATS permits calling to anywhere within the continental United States (outside of the state in which the call was originated). Service Area 6 adds Alaska and Hawaii.

In June 1981 there was a significant restructuring of how WATS is billed. Before that time WATS was available in either full business day WATS lines (up to 240 hours of usage per month per line at a flat rate with hours over 240 billed at an additional hourly rate)[25] or measured time WATS lines (up to ten hours of usage per month per line at a flat rate with hours over ten billed at an additional hourly rate). Today, WATS has no minimum usage requirement (but there is a monthly recurring charge per line) and every call contributes to the monthly bill. WATS costs are calculated from the average use per WATS line per rate period (and the distance as determined by the Service Area capability of the WATS line). Calls are measured in one second increments and the total number of minutes must be greater than or equal to the total number of calls in each rate period during the billing period (minimum average time requirement--MATR).

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[24]The number of WTS calls that can be made simultaneously is also also limited by the number of dial 9 trunks, but these are usually more numerous than WATS lines.

[25]For 240 hours of usage in an average 22 business day month the circuit must be in use almost 11 hours per business day. **That's definitely a full business day!** This is the source of the "WATS is free" syndrome. Companies were underutilizing their WATS lines and permitted, if not encouraged, personal calls via the company's WATS lines. (This sounds a lot like the rationale for non-official use of AUTOVON.)

B. SCC SWITCHED VOICE NETWORK SERVICES

SCCs offer basically two types of services which look remarkably like AT&T's services: dial access service and dedicated (or direct) access service.[26] The dial and direct access services offered by MCI and GTE Sprint are described below.[27]

1. Dial Access Services

Dial access service most closely resembles AT&T's MTS (without operator assistance--as actor Cliff Robertson has pointed out in the recent AT&T television commercials). A customer dials a local access (telephone) number and a billing code to access the SCC network and, finally, the desired number to be called. Like AT&T's MTS, the customer is billed for SCC dial access service according to the duration of the call, the rate period, and the distance to the called number. The rate periods used by AT&T, MCI, and GTE Sprint are listed in Table II.[28] Non-recurring and monthly recurring charges for AT&T MTS, and MCI and GTE Sprint dial access services are shown in Table III. (AT&T's current and proposed MTS tariff rates, and the current tariff rates for MCI Execunet and GTE Sprint's SPRINT are found in

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[26]A third service is also offered by some of the SCCs which provides inward calling capability. This service will not be discussed in this thesis as most base telecommunications managers will not have a requirement for such service. Installations or activities (such as recruiting units) currently using In-WATS (800 service) may want to obtain information on SCC inward calling service offerings.

[27]The services of MCI and GTE Sprint were investigated since 1) they are the two biggest SCCs and 2) efforts to obtain information from ITT and Western Union were discouragingly unfruitful. A base telecommunications manager investigating SCC services should be cautioned not to call the toll free number for the SCCs and expect to have his/her questions answered. The best bet is to contact the nearest sales office for the SCC and know what information is needed.

[28]The rate periods, rates, and recurring and non-recurring charges which appear in this chapter are from references 33, 34, 35, 36, 37, 38, and 39.

Appendix E.) Unlike AT&T's MTS, SCC dial access service currently requires dialing many digits to access the network.[29]

TABLE II

AT&T, MCI, and GTE Sprint Rate Periods

Business Day			
8:00 am	to but not including	5:00 pm	Monday-Friday
Evening			
5:00 pm	to but not including	11:00 pm	Sunday-Friday
Night and Weekend			
11:00 pm	to but not including	8:00 am	All days
8:00 am	to but not including	11:00 pm	Saturday
8:00 am	to but not including	5:00 pm	Sunday

a. MCI Execunet Service

MCI offers dial access service in two flavors: Network-only Termination[30] and "Universal Termination."[31]

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[29]As mentioned in Chapter II, customers of the Northwest Iowa Telephone Company can dial a single digit to access MCI's Execunet service. As SCCs are given "equal access" to the long distance market, more customers will be provided single digit access to the SCCs (assuming they are in an area in which an SCC offers service). Another way to beat the extra digits is by using an autodialer or a least cost routing device (particularly for a big user).

[30]AT&T only offers Network-only Termination service, but all cities are on the AT&T network.

[31]The term "Universal Termination" is misleading. While "Universal Termination" service offers coverage which is greater than that provided by Network-only Termination, it, too, has its limitations. MCI's "Universal Termination" service allows a user to complete calls to anywhere in the continental United States, Hawaii, and Puerto Rico and to

TABLE III

AT&T MTS, and MCI and GTE Sprint Dial Access Services
Monthly Recurring and Non-recurring Charges

AT&T MTS

No Monthly Recurring or Non-recurring Charges

MCI Execunet

Monthly Recurring

$75 minimum usage or $10 charge

SPRINT

Monthly Recurring

$ 5 minimum usage

Network, or Execunet Service, calling can be originated from the cities in Table IV and can be completed to any network city.[32] Calls to non-network cities (or "Universal Termination" calling) can be originated only from cities listed in Table V. MCI calls this Execunet Service with Nationwide Calling. Calls made via Execunet Service with Nationwide Calling may be completed to anywhere in the continental United States, Hawaii, and Puerto Rico and to some locations in Canada. Calls to Alaska cannot be made

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some locations in Canada. MCI does not offer calling to Alaska. "Universal Termination" with GTE Sprint permits calling to anywhere in the continental United States, Hawaii, Alaska, Puerto Rico, and the U.S. Virgin Islands. (See the subsection in this chapter on "Intrastate Service" for a discussion on intrastate calling.) AT&T's MTS service can be regarded as the only truly "Universal Termination" service since a user can call anywhere in the world (...perhaps with some difficulty).

[32]A complete listing of the area codes and prefixes on the MCI network is found in Appendix C.

TABLE IV

MCI Execunet Service Originating Cities

Abilene, TX
Akron, OH
Albany, NY
Albuquerque, NM
Allentcwn, PA
Altoona, PA
Amarillo, TX
Anaheim, CA
Ann Arbor, MI
Annapolis, MD
Atlanta, GA
Augusta, GA
Austin, TX
Bakersfield, CA
Baltimcre, MD
Bartlesville, OK
Baton Rouge, LA
Beaumont, TX
Bel Air, MD
Bensonville, IL
Birmingham, AL
Bloomirgtor, IN
Blue Island, IL
Boise, ID
Boston, MA
Bridgeport, CT
Bristol, TN
Brownsville, TX
Bryan, TX
Buffalo, NY
Butler, PA
Cambridge, MD
Camden, NJ
Capistrano Valley, CA
Carlisle, PA
Cedar Rapids, IA
Champaign, IL
Channelview, TX
Charleston, WV
Charlotte, NC
Chattanooga, TN
Cheyenne, WY
Chicago, IL
Cincinnati, OH
Clearwater, FL
Cleveland, CH
Collegeville, PA
Colorado Springs, CC
Colton, CA
Columbia, SC
Columbus, CH
Corpus Christi, TX
Creve Coeur, MO
Dallas, TX
Danbury, CT
Davenport, IA
Dayton, OH
Deer Park, NY
Denison, TX
Denton, TX
Denver, CO
Des Moines, IA
Detroit, MI
Downers Grove, IL
Durham, NC
Easton, MD
Edgemont, IL
Edinburg, TX
El Paso, TX
Elyria, OH
Erie, PA
Eugene, OR
Flint, MI
Florence, NJ
Forest Park, IL
Ft Collins, CO
Ft Lauderdale, FL
Ft Wayne, IN
Ft Worth, TX
Frederick, MD
Fredericksburg, VA
Fresno, CA
Frisco, TX
Galveston, TX
Garden City, NY
Gary, IN
Geneva, IL
Glenview, IL
Grand Rapids, MI
Greeley, CO
Greensboro, NC
Greensburg, PA
Greensville, SC
Greenwich, CT
Hackensack, NJ
Hagerstown, MD
Harlingen, TX
Harrisburg, PA
Hartford, CT
Houma, LA
Houston, TX
Huntsville, AL
Huntsville, TX
Indianapolis, IN
Iowa City, IA
Jackson, MS
Jacksonville, FL
Johnstown, PA
Joliet, IL
Joplin, MO
Kalamazoo, MI
Kansas City, MO
Kenosha, WI
Killeen, TX
Knoxville, TN
Lafayette, LA

TABLE IV (Continued)

MCI Execunet Service Originating Cities

Lancaster, CH
Lancaster, PA
Langhorne, PA
Lansing, MI
Las Vegas, NV
Lawrence, KS
Leesburg, VA
Lexington, KY
Lexington, MA
Lincoln, NE
Little Rock, AR
Laredo, TX
Long Branch, NJ
Longmont, CO
Longview, TX
Lorain, OH
Los Angeles, CA
Louisville, KY
Lowell, MA
Lubbock, TX
Macon, GA
Madison, WI
Manassas, VA
Manchester, NH
Manhattan, KS
Marion, OH
Marshall, TX
Matawan, NJ
Memphis, TN
Miami, FL
Midland, MI
Milwaukee, WI
Minneapolis, MN
Mobile, AL
Modesto, CA
Montgomery, AL
Morristown, NJ
Muncie, IN
Nashua, NH
Nashville, TN
Natick, MA
Nederland, TX
Newark, NJ
New Bedford, MA
New Braunfels, TX
New Brunswick, NJ
New City, NY
New Haven, CT
New Orleans, LA
Newport News, VA
New York, NY
Norfolk, VA
Norristown, PA
Norwalk, CT
Ogden, UT
Oklahoma City, OK
Omaha, NE
Ontario, CA
Orlando, FL
Painesville, OH
Palo Alto, CA
Palm Desert, CA
Pensacola, FL
Peoria, IL
Petersburg, VA
Philadelphia, PA
Phoenix, AZ
Pittsburgh, PA
Pittsfield, MA
Pleasanton, CA
Pontiac, MI
Portland, OR
Prairie View, TX
Providence, RI
Provo, UT
Pueblo, CO
Racine, WI
Rahway, NJ
Raleigh, NC
Randolph, MA
Reading, PA
Reno, NV
Richmond, VA
Roanoke, VA
Rochester, MN
Rochester, NY
Rochester, PA
Rockford, IL
Round Lake, IL
Sacramento, CA
Saginaw, MI
St Charles, MO
St Cloud, MN
St Joseph, MO
St Louis, MO
Salem, OR
Salisbury, MD
Salt Lake City, UT
San Angelo, TX
San Antonio, TX
Sandusky, OH
San Diego, CA
San Francisco, CA
San Jose, CA
San Rafael, CA
Santa Barbara, CA
Santa Rosa, CA
Savannah, GA
Scranton, PA
Seattle, WA
Sergeant Bluff, IA
Shreveport, LA
Sioux City, IA
South Bend, IN
Spartanburg, SC
Springfield, IL

TABLE IV (Continued)

MCI Execunet Service Originating Cities

Springfield, MA	Valley Park, MO
Springfield, MO	Ventura, CA
Springfield, OH	Vista, CA
Stamford, CT	Waco, TX
Stockton, CA	Washington, DC
Syracuse, NY	Washington, PA
Tampa, FL	Waterloo, IA
Temple, TX	West Palm Beach, FL
Terminal, TX	Wheeling WV
Texarkana, TX	White Plains, NY
Toledo, OH	Witchita, KS
Topeka, KS	Witchita Falls, KS
Trenton, NJ	Williamstown, NJ
Tucson, AZ	Wilmington, DE
Tulsa, OK	Winston-Salem, NC
Tyler, TX	Worcester, MA
Uniontown, PA	York, PA
Utica, NY	Yorktown Heights, NY
Vallejo, CA	Youngstown, OH

via MCI. Calls completed to cities on the MCI network are billed at a lower rate than calls completed to non-network cities. MCI refers to this as a two-tiered system--Tier 1 to network cities and Tier 2 to non-network cities. The duration of an Execunet call (with or without Nationwide Calling) is rounded to the next higher full minute for calculating the cost of the call.

b. SPRINT Service

GTE Sprint's latest tariff revision (Jan 1984) combined two services, Residential Sprint and Business Sprint, into one service now called SPRINT.[33] Now all calls, network and non-network, are billed at the same rate. Previously, Residential and Business Sprint services had separate, two-tiered rate structures as Execunet. SPRINT calls may be originated in any of the cities in Table VI and

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[33]SPRINT stands for Switched Private Network Telecommunications.

TABLE V

MCI Execunet Service with Nationwide Calling
Originating Cities

Akron, OH	Lexington, MA
Allentcwn, PA	Longmont, CO
Amarillo, TX	Los Angeles, CA
Anaheim, CA	Louisville, KY
Ann Arbor, MI	Lowell, MA
Atlanta, GA	Lubbock, TX
Austin, TX	Memphis, TN
Baltimcre, MD	Miami, FL
Bartlesville, IL	Minneapolis, MN
Beaumont, TX	Muncie, IN
Bensonville, IL	Natick, MA
Bloomington, IN	Nederland, TX
Blue Island, IL	Newark, NJ
Bcston, MA	New Braunfels, TX
Butler, PA	New Brunswick, NJ
Canton, OH	New Haven, CT
Capistrano Valley, CA	New York, NY
Chicagc, OH	Norristown, PA
Cincinnati, OH	Oklahoma City, OK
Cleveland, CH	Omaha, NE
Cclllegeville, PA	Painesville, OH
Cclorado Springs, CO	Philadelphia, PA
Cclumbus, OH	Phoenix, AZ
Ccrpus Christi, TX	Pittsburgh, PA
Creve Couer, MD	Pleasanton, CA
Dallas, TX	Pontiac, MI
Denver, CO	Randolph, MA
Des Moines, IA	Reading, MA
Detroit, MI	Rochester, NY
Dcwners Grcve, IL	Round Lake, IL
Elyria, OH	Sacramento, CA
Fcrest Park, IL	San Antonio, TX
Ft Collins, CO	San Diego, CA
Ft Lauderdale, FL	San Francisco, CA
Ft Worth, Tx	San Rafael, CA
Galveston, TX	Sioux City, IA
Geneva, IL	St Charles, MO
Glenview, Il	St Joseph, MO
Greeley, CC	St Louis, MO
Greensburg, PA	Terminal, TX
Hackensack, NJ	Toledo, OH
Hartford, CI	Tucson, AZ
Hcuston, TX	Uniontown, PA
Indianapolis, IN	Vallejo, CA
Jchnstown, PA	Ventura, CA
Kansas City, MO	Washington, DC
Lancaster, CH	Washington, PA
Langhorne, PA	Worcester, MA

may be completed tc anywhere in the continental United States, Hawaii, Alaska, Puerto Rico, and the U.S. Virgin

Islands. (Calls originated in Hawaii cannot be completed to Puerto Rico or the U.S. Virgin Islands.) The duration of SPRINT calls are also rounded to the next higher full minute for calculating charges. The rate for SPRINT service is varied according to the total amount of the bill so that higher usage has a higher discount. (See Appendix E.)

c. Additional Features with MCI and GTE Sprint Dial Access Services

MCI and GTE Sprint offer several additional features with their dial access services. These are least cost routing, group billing, speed dialing, travel/credit card service, and magnetic tape billing. Least cost routing enables the use of rotary or pulse dial telephones to complete calls via the SCC dial access services. (It's a must at most military installations.) Probably the feature of most interest to a military installation, besides least cost routing, would be the group billing. This feature permits bills itemized according to billing (authorization) code. MCI's Corporate Account Service offers 50 accounts[34] at no monthly service charge if the combined monthly bill is at least $2,500. There is no charge for each additional code for every $50 added to the total monthly bill. GTE Sprint's group billing service is called Corporate Billing Arrangement. It offers 50 codes at no monthly charge with a minimum of $1,500 usage per month and each additional code (up to 200) is free for every $20 of usage added to the monthly bill. With a bill of $15,000 per month 2500 codes can be provided at no cost. Both MCI and GTE offer additional accounting codes (up to 99 accounting codes per authorization code) for a small monthly fee.

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[34]The numbers of accounts which are given here are provided as examples of the service offered. Other quantities, smaller and larger, are available per the SCC's established rates.

TABLE VI

SPRINT Originating Cities

Abilene, TX
Akron, OH
Albany, GA
Albany, NY
Albuquerque, NM
Allentown, PA
Altoona, PA
Amarillo, TX
Anaheim, CA
Anderson, IN
Annapolis, MD
Ann Arbor, MI
Antioch/Pittsburg, CA
Atlanta, GA
Athens, GA
Atlantic City, NJ
Austin, TX
Baltimore, MD
Bakersfield, CA
Baton Rouge, LA
Beaumont, TX
Bedford, MA
Beverly Hills, CA
Binghamton, NY
Birmingham, AL
Birmingham, MI
Bloomington, IN
Boca Raton, FL
Boise, ID
Boulder, CO
Bridgeport, CT
Buffalo, NY
Burlingame, CA
Camden, NJ
Canoga Park, CA
Canton, OH
Capistrano Valley, CA
Casper, WY
Cedar Rapids, IA
Champaign/Urbana, IL
Charleston, SC
Charleston, WV
Charlotte, NC
Chattanooga, TN
Cheyenne, WY
Chicago, IL
Cincinnati, OH
Clearwater, FL
Cleveland, OH
Colorado Springs, CO
Columbia, SC
Columbus, GA
Columbus, OH
Compton, CA
Conshohocken, PA
Corpus Christi, TX
Dallas, TX
Danbury, CT
Davenport, CT
Dayton, OH
Decatur, IL
Denton, TX
Denver, CO
Des Moines, IA
Detroit, MI
Durham, NC
Elk Grove, IL
El Monte, CA
El Paso, TX
El Segundo, CA
Elyria, OH
Encinitas, CA
Escondido, CA
Erie, PA
Eugene, OR
Evansville, IN
Fair Oaks
/Roseville, CA
Fall River, MA
Farmington, MI
Feasterville, PA
Flint, MI
Ft Collins, CO
Ft Lauderdale, FL
Ft Wayne, IN
Ft Worth, TX
Fremont/Newark, CA
Fresno, CA
Gary, IN
Glen Burnie, MD
Glendale, CA
Grand Rapids, MI
Greeley, CO
Green Bay, WI
Greensboro, NC
Greenville, SC
Hammond, IN
Harrisburg, PA
Hartford, CT
High Point, NC
Honolulu, HI
Houma, LA
Houston, TX
Huntington, WV
Indianapolis, IN
Inglewood, CA
Jackson, MS
Jacksonville, FL
Jersey City, NJ
Kalamazoo, MI
Kansas City, MO
Kaysville/Clearfield
/Ogden, UT
Kenosha, WI
Knoxville, TN
Kokomo, IN

TABLE VI (Continued)

SPRINT Originating Cities

Lafayette, IA
La Grange, IL
La Jolla, CA
Lake Charles, LA
Lancaster, CA
Lansing, MI
Las Vegas, NV
Lawrence, MA
Leonia, NJ
Lexington, KY
Lincoln, NE
Linden, NJ
Little Rock, AR
Livermore, CA
Lodi, CA
Long Island, NY
Longmont, CO
Lorain, OH
Los Angeles, CA
Louisville, KY
Lowell, MA
Lubbock, TX
Macon, GA
Madison, WI
Manchester, NH
Mansfield, OH
Melrose, MA
Memphis, TN
Mentor, OH
Metuchen, NJ
Miami, FL
Midland, TX
Middleton, OH
Milwaukee, WI
Minneapolis, MN
Mobile, AL
Modesto, CA
Montgomery, AL
Morristown, NJ
Morton Grove, IL
Muncie, IN
Nashua, NH
Nashville, TN
Natick, MA
New Bedford, MA
New Britain, CT
New Brunswick, NJ
New Haven, CT
New Orleans, LA
Newport, CA
Newport News, VA
New York, NY
Niagra Falls, NY
Norfolk, VA
Norristown, PA
Norwalk, CT
Oakland, CA
Oak Lawn, IL
Odessa, TX
Oklahoma City, OK
Omaha, NE
Ontario, CA
Orange/E Orange
/W Orange, NJ
Orangeville, NY
Orlando, FL
Palm Desert, CA
Palm Springs, CA
Palo Alto, CA
Passaic, NJ
Pensacola, FL
Peoria, IL
Petaluma, CA
Philadelphia, PA
Phoenix, AZ
Pinole/Vallejo, CA
Pittsburgh, PA
Portland, ME
Portland, OR
Princeton
/Penns Neck, RI
Providence, RI
Provo/Orem, UT
Pueblo, CO
Queens, NY
Racine, WI
Raleigh, NC
Randolph, MA
Reading, PA
Red Bank, NJ
Reno, NV
Richmond, VA
Roanoke, VA
Rochester, MN
Rochester, NY
Rockford, IL
Roseville, MI
St Charles, MO
St Joseph, MO
St Louis, MO
Sacramento, CA
Salem, OR
Salinas, CA
Salt Lake City, UT
San Antonio, TX
San Bernardino, CA
San Diego, CA
San Francisco, CA
San Jose, CA
San Rafael, CA
Santa Ana, CA
Santa Barbara, CA
Santa Cruz, CA
Santa Rosa, CA
Sarasota, FL

TABLE VI (Continued)

SPRINT Originating Cities

Saticoy/Oxnard /Ventura, CA	Tucson, AZ
Scranton, PA	Tulsa, OK
Seattle, WA	Tyler, TX
Shreveport, LA	Vacaville, CA
Sioux City, IA	Van Nuys, CA
Sioux Falls, SD	Waco, TX
South Bend, IN	Walnut Creek, CA
Spartanburg, SC	Warren, OH
Springfield, IL	Washington, DC
Springfield, MA	Waterbury, CT
Springfield, OH	Wayne, MI
Stamford, CT	West Palm Beach, Fl
Stockton, CA	Westport, CT
Syracuse, NY	Westwood, NJ
Tacoma, WA	White Plains, NY
Tampa, FL	Witchita Falls, TX
Terminal, TX	Witchita, KS
Terre Haute, IN	Wilkes-Barre, PA
Thousand Oaks, CA	Wilmington, DE
Toledo, OH	Winston-Salem, NC
Topeka, KS	Worcester, MA
Trenton, NJ	York, PA
	Youngstown, OH

d. Advantages and Disadvantages of Dial Access Service

Dial access service offers the following advantages:

1. With additional billing numbers, bills are automatically sorted for verification.
2. Some dial access services are billed in less than one minute increments--a potential cost savings.
3. The number of possible simultaneous calls is only limited by the number of dial 9 trunks.

Some of the disadvantages of dial access service are:

1. If the SCC has a lot of customers in the area there may be access problems. These access problems may depend upon how often the SCC upgrades their equipment to provide the necessary levels of circuits/service.

2. Currently, unless the customer uses an autodialer or has speed dialing or a similar capability, there are a lot of numbers which must be dialed because of the local access number and the billing code. (This problem will disappear with "equal access.")
3. Since there are no operators, there are no person-to-person, collect, or third number calls (most base telecommunications managers would be glad not to have to worry about these, anyway).
4. Every call which results in getting the SCC dial tone will cost (if there is a charge for the local or long distance call to access the SCC network), not just the ones which result in a completed long distance call.
5. Basically, there is no overseas calling capability.

e. When to Consider Using Dial Access Service

When should a base telecommunications manager consider using dial access service?

- **When it costs less than the service currently being used!**
- If local calls are free and the local access number truly is local.
- If a lot of calls must be made at the same time. (Only limited by the number of dial 9 trunks.)
- If single digit access to the SCC is available, or, if not available, autodialing or speed dialing capability is available.
- If DTMF signalling is available (either at the switchboard or at each call station). (Not necessary if single digit access is available.)

2. Dedicated Access Services

Dedicated access service is the SCC's marketing answer to AT&T's WATS. The customer accesses the SCC network through a dedicated access line (DAL), eliminating the need to dial the local access number or billing code. Dedicated access services also use usage sensitive pricing. Table VII lists the non-recurring and monthly recurring charges for AT&T WATS, and MCI and GTE Sprint dedicated access services. (AT&T's current and proposed WATS tariff rates, and the current tariff rates for MCI WATS and GTE Sprint's Direct Sprint are found in Appendix E.)

a. MCI Network Service and MCI WATS

MCI offers dedicated access service in the same two flavors as their dial access service: Network-only Termination and "Universal Termination." MCI Network Service allows calling only to network cities, while calls made via MCI Network Service with Universal Termination can be completed to anywhere in the continental United States, Hawaii, and Puerto Rico and to some locations in Canada. MCI has attached the name MCI WATS to their MCI Network Service with Universal Termination. Although the name suggests it, MCI WATS cannot be viewed as equivalent service with AT&T WATS since calls cannot be completed to Alaska. Table VIII lists the cities from which both of these services may be originated. Durations of calls via these services are rounded to the next higher thirty second increment,[35] and, like AT&T WATS, MCI's dedicated access services have a one minute minimum average time requirement.

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[35]There is a savings when billing is in less than one minute increments. Self states for an average call length of five minutes that one second, six second, 30 second, and initial minute then 30 second increment billing will save 10, 9, 5, and 3.8 percent, respectively, of the cost of a call billed in full minute increments (like AT&T MTS, MCI Execunet, and GTE Sprint's SPRINT) [Ref. 40].

TABLE VII

AT&T WATS, and MCI and GTE Sprint Dedicated Access Services Monthly Recurring and Non-Recurring Charges

AT&T WATS (Current Tariff Rates)

Monthly Recurring

$31.65 per line

Non-Recurring

Order	$ 51.80 per order
Installation	$123.00 per line

AT&T WATS (Proposed Tariff Rates)

Monthly Recurring

$56.65 per line

Non-Recurring

Order	$ 51.80 per order
Installation	$123.00 per line

MCI Network Service

Monthly Recurring

$75 mirimum charge for all usage
$85 per line

Non-Recurring

Order	$ 50 per order
Installation	$120 per line
Cancel Order	$130

MCI WATS
(MCI Network Service With Universal Termination)

Monthly Recurring

$75 mirimum charge for all usage
$100 per line termination charge
(or cost + $10, whichever is greater)

Non-Recurring

Order	$ 50 per order
Installation	$120 per line
Cancel Order	$130

TABLE VII (Continued)

AT&T WATS, and MCI and GTE Sprint Dedicated Access Services Monthly Recurring and Non-Recurring Charges

Direct Sprint

Monthly Recurring	
$350 per line minimum usage	
Termination at Rate Center	$ 5 per line
Termination within LDA (Local Distribution Area)	$35 per line
Termination outside LDA but within state boundaries	$35 per line + $4 per mile outside LDA boundary
Termination outside LDA and crossing state boundaries	$35 per line + $4 per mile from customer premise to switch location
Circuit Termination	$65 per line
No Non-Recurring Charges	

b. Direct Sprint Service

GTE Sprint's Direct Sprint service is also available in Network-only Termination and "Universal Termination." Calls for both types of service may be originated from the cities in Table IX.[36] Direct Sprint calls are measured in six second increments (the duration of the call is rounded up to the next higher six second increment). The rate structure is complicated by the fact that, in addition to network and non-network rates which are mileage independent, there are mileage sensitive rates for calls to Alaska and to and from Hawaii (other than Honolulu). Direct Sprint also uses a one minute minimum average time requirement.

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[36]Appendix D provides a complete listing of area codes and prefixes on GTE Sprint's network.

TABLE VIII

MCI Network Service and MCI WATS Originating Cities

Akron, OH	Memphis, TN
Anaheim, CA	Miami, FL
Atlanta, GA	Minneapolis, MN
Baltimore, MD	Newark, NJ
Boston, MA	New York, NY
Chicago, IL	Oklahoma City, OK
Cincinnati, OH	Omaha, NE
Cleveland, OH	Philadelphia, PA
Columbus, OH	Phoenix, AZ
Dallas, TX	Pittsburgh, PA
Dayton, OH	St Louis, MO
Denver, CO	San Antonio, TX
Des Moines, IA	San Diego, CA
Detroit, MI	San Francisco, CA
Ft Worth , TX	San Jose, CA
Hartford, CT	Stamford, CT
Houston, TX	Toledo, OH
Indianapolis, IN	Tulsa, OK
Kansas, City , MO	Washington, DC
Los Angeles, CA	Wilmington, DE
Louisville, KY	

c. Additional Features with MCI and GTE Sprint Dedicated Access Service

Least cost routing, accounting codes, and magnetic tape billing are additional features offered with MCI Network Service, MCI WATS, and Direct Sprint Service. The least cost routing offering is a boon for those locations that do not have a sophisticated switch with least cost routing capability--which, unfortunately, includes nearly all military installations. Microprocessors leased from the carrier permit completing calls via the most economical method whether via AT&T MTS, WATS lines, SCC TALs, FX lines, or whatever. The accounting codes are also noteworthy. Rather than getting a bulk bill as with AT&T WATS, the accounting codes allow itemizing all calls by accounting code, making it easier to control the costs of

TABLE IX

Direct Sprint Originating Cities

Atlanta, GA	Los Angeles, CA
Baltimore, MD	Miami, FL
Boston, MA	Milwaukee, WI
Buffalo, NY	New Orleans, LA
Chicago, IL	New York, NY
Charlotte, NC	*Omaha, NE
Cincinnati, OH	Orangeville, NY
Cleveland, CH	Philadelphia, PA
Dallas, TX	Phoenix, AZ
Denver, CO	Rochester, NY
Detroit, MI	San Francisco, CA
Honolulu, HI	San Jose, CA
Houston, TX	Seattle, WA
*Indi, CA	Washington, DC

*Direct Sprint with Universal Calling not available

the calls. Accounting codes should be viewed as essential items for most military installations.

d. Advantages and Disadvantages of Dedicated Access Service

The following are some of the advantages of using dedicated access service:

1. No local access number or billing code to dial.
2. Usually less expensive than the carrier's dial access service.[37]
3. May permit removing local lines (dial 9 trunks) and thereby save money.
4. Call detail billing is available itemizing each call.

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[37]Potential users must recognize that there is a break-even point since there are fixed costs (monthly recurring as well as order and installation costs) associated with dedicated access services. The combined sum of the fixed costs and the usage costs must be less than the costs of the service currently being used. Also, it is possible that the rates themselves may not be lower than the dial access service rates.

Some of the disadvantages of dedicated access service are:

1. Only one call at a time per DAL. If the circuit is busy, it's busy! DALs create the same problem as WATS--when the circuits are busy telephone users call via AT&T MTS anyway so it costs more.[38] This situation actually costs more twice because of lower overall usage of the WATS lines or DALs, which costs a higher rate for all calls, plus a higher cost for the MTS call. (Note that with least cost routing, telephone users do not realize they are using anything diferent.)
2. If the service is referred to as a WATS or WATS-type service, remember that many people have the misconception that WATS is free. WATS or WATS-type service is not free; in fact, it can be very expensive unless it is managed properly. Newton suggests replacing WATS lines with LATS (Limited Access Telephone Service) lines as a money saving measure:

> ....send a memo around the company to all employees saying, "We have cancelled our WATS lines because of the expense. We have now subscribed to a brand new telephone company service, called IATS--Limited Access Telephone Service. IATS lines are cheaper than WATS lines (which is why we got the LATS lines), but now all our LATS calls--each and every one--are billed and charged by the length of the call in minutes and seconds and by time of day."
>
> What have we done? We have killed the myth that WATS lines are free by cancelling our WATS lines. We have introduced the correct logic that calls cost money based on the time of day they were made and the length of the call. There is, of course, no such animal as a LATS line. [Ref. 41]

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[38]Sometimes the amount of traffic which is being diverted to MTS (or other dial access service) is an indicator that there are insufficient WATS lines or DALs installed.

e. When to Consider Using Dedicated Access Service

When should a base telecommunications manager consider using direct access service?

- Again, when it costs less than the service currently being used. (Remember to consider fixed costs.)
- If WATS is already being used at the installation.
- If the number of long distance calls justifies several DAIS.
- If local lines (dial 9 trunks) can be removed when DALS are installed.
- When call detail billing is needed.

3. Intrastate Service

SCCs are interstate carriers. Prior to the AT&T divestiture they were able to provide intrastate service only in those states where they were authorized by the state's Public Utilities Commission (PUC). One of the changes mandated by the AT&T divestiture agreement was that the divested operating companies (or BOCs for Bell Operating Companies) would provide long distance service within the LATAs (Local Access and Transport Areas),[39] or intra-LATA calling, and calling between LATAs (inter-LATA) would be provided by AT&T and other carriers like the SCCs and resellers. Even so, all calls within a state are still subject to regulation by the state PUC. So far, SCCs have

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[39]Local Access and Transport Areas, or LATAs, were created as a method of defining the boundaries within which the divested operating companies could provide "local" service. There are 161 LATAs. Idaho, Maine, New Mexico, and the District of Columbia each have one LATA for the entire state or district. All other states have more than one LATA.

been authorized to offer (at least partial) intrastate calling in six states [Ref. 20]. Simon and Whalen point out that:

> The PUCs also have the right, if they wish, to allow the "interexchange carriers" (also called "inter-LATA carriers") like AT&T, MCI, ITT, etc. to carry calls within LATAs in the states, though the BOCs are expected to object to this [Ref. 42].

Historically, calls which originate and terminate on the SCC network within a state have been completed. Calls within the State of California made via MCI's dial access and dedicated access services with "Universal Termination" are completed only if the called locations are on the network. Although they are not shouting it from the rooftops, GTE Sprint does not restrict intra-state (inter- or intra-LATA) calling via SPRINT or Direct Sprint with Universal Calling. They cannot offer or advertise service (in California) for solely intra-LATA calls, but no one checks.

The bottom line is: Potential users must check with the SCCs concerning their service offerings in a particular state.

C. USE AND PROCUREMENT OF SCC SERVICES IN THE DEPARTMENT OF DEFENSE

1. Use of SCC Services in the Department of Defense

In 1980, the author conducted an Air Staff (Headquarters USAF) directed study of the potential use of SCC services at all Strategic Air Command (SAC) installations in the continental United States. At that time the SCC marketing people seemed reluctant to provide information and assistance in spite of the potential to get part of the several hundred thousand dollars that are spent by SAC installations annually for long distance telephone service.

The major problems[40] with using SCC services at that time were:

a. SCC systems presently serve only major metropolitan areas. Calls can only be placed to and from cities within the SCC's network.

(1) Most SAC bases are not within the calling areas of the metropolitan cities served.

(2) Bases with SCC system accessibility will need to develop and maintain directories listing the cities and/or area and NNX codes served by the SCC because of the limited service.

b. Dual tone multi-frequency (DTMF or touch tone) signalling is needed to access the SCC systems. At most bases, this would require operator assistance to dial a seven digit access number, a multiple digit billing number, plus the ten digit telephone number to be called [Ref. 43].

But, as was mentioned in the previous chapter, most of these problems no longer exist since SCCs offer "Universal Termination,"[41] (from selected network cities) as well as DALs or least cost routing devices which enable calls to be completed without dialing the local access number or the billing code and from a rotary or pulse dial telephone instrument. Also, with the growth of the SCC networks more and more military installations are within their reach. Even with these problems corrected, SCC usage in the Department of Defense has been slow in getting started.[42] In fact, SCC use throughout the Department of

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[40]Most of these problems were already mentioned in Chapter II.

[41]MCI plans to offer "universal origination" to its credit card customers in March 1984, providing access to the MCI network from any city in the United States through AT&T WATS or MCI circuits for an additional per minute charge.

[42]In 1982 MCI was providing service to only one Department of Defense activity, the Defense Telephone Service-Washington. It is highly likely that this was the only Department of Defense activity using any SCC services at that time.

Defense is currently limited to just a handful of places.[43] Worse yet (in the author's opinion), direction on their procurement and use is virtually non-existent. Why should the Department of Defense be concerned? Because there is money to be saved! According to MCI:

> ...While we have been unable to obtain an accurate figure for DoD's current cost for [administrative long distance telephone services,] estimates place these costs at a minimum of $500 million annually. The potential savings may be as high as $125 million annually.... [Ref. 44]

2. Procuring SCC Services

Sensing a hesitancy on the part of military telecommunications managers to move away from AT&T into the uncharted waters (as far as the Department of Defense was concerned) of the SCCs, MCI's Director of Government Marketing sent a letter to the Deputy Under Secretary of Defense (C3I) in August 1982 urging a stronger position for competitive procurement of long distance services. An attachment to this letter discussed the Federal Government's policy on competitive procurement of telecommunications services. An excerpt follows:

> The U. S. Government has specific, established policies which require agencies to compete their telecommunications requirements. The Defense Acquisition Regulations clearly state this duty in DAR 22-1005.1(b) which states that:
>
> > ...there are locations at which no single communications common carrier has the exclusive right to provide the required service. When this is the case and more than one common carrier is authorized and can provide the required service, the procurement shall be made from the source offering the lowest cost to the Government, if practicable.

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[43]Per the author's conversations with offices in the Department of Defense and with SCC marketing personnel.

Similarly, DAR 1-300.1 requires all procurements to be performed competitively to the maximum practicable extent. In other words, an agency must compete its requirements for telecommunications service when it is able to do so. And since MCI's service now covers virtually the entire country, there is no excuse not to compete telecommunications service needs as the DAR requires.

Numerous DoD components have taken action to implement the fundamental policy position set forth in the DAR. The Defense Commercial Communication Office (DECCO) recently issued a "Policy for Seeking Competition for CONUS Private Line Services." The effective date is May 7, 1981. DECCO policy provides that increasing degrees of competition shall be used as the requirement expands....

.....

...DECCO clearly requires competition in private line services. The same policy considerations also apply to procurement of DDD or WATS equivalent message service, including MCI's Network Service.

The policy expressed in these documents is simply a reiteration of a competitive communications policy which DoD has stressed for many years. For example, by memorandum dated December 23, 1978, for the Secretaries of the Military Departments, the Chairmen, Joint Chiefs of Staff, and numerous other DoD officials, Gerald Dineen stated that it is DoD policy that procurements for base telephone systems "will be completed to the maximum extent possible..." (Emphasis in the original.)

More recently, Deputy Secretary Frank Carlucci issued a memorandum for broad dissemination within DoD urging DoD managers to increase the use of competition in the procurement process. Mr. Carlucci's memorandum, dated July 27, 1981, stated categorically that:

> The value of competition in the acquisition process is one of the most widely accepted concepts. We believe that it reduces the costs of needed supplies and services, improves contractor performance, helps to combat rising costs, increases the industrial base, and ensures fairness of opportunity for award of government contracts. Despite our beliefs and efforts at furthering competition, there is a serious concern that our achievements are not adequate. Many in government and industry believe that we award too many contracts without adequate competition.
>
> I am therefore asking that managers in all levels review their efforts to obtain maximum competition of their contractual requirements. (Emphasis added.)

This last statement is particularly applicable to DoD base communications managers. For years, DoD base requirements have been sole sourced to AT&T. Mr.

Carlucci's memorandum clearly requires reevaluation of this practice, and the injection of more competition intc lccal communications procurements.

.....

In summary, established federal policy mandates competition ir all procurements to the fullest extent practicable. This pclicy is well established in communications and all other areas of federal procurement. There is nc justification for a base communications manager to continue sole sourcing AT&T. Such a practice is clearly prohibited by the policies and regulaticns set forth above. [Ref. 44]

Subsequent tc receiving this letter, the Assistant Deputy Secretary of Defense (Telecommunications) sent a memorandum to the Services' senicr communicators requesting: "Your ccmments on the advisability and feasibility of using MCI metered use service...and like offerings are sclicited." [Ref. 45]. Apparently the Services paid some credence to the tasking, as there are a few more installations using SCC services ncw than there were at the time of the tasking.

Cne methcd, cf several being used (on a very limited basis) in the Department of Defense to procure SCC services, is through a strictly competitive procurement process. The Air Force is currently pursuing long distance telephone services this way. The Air Force Communications Command's Continental Communications Division has been publishing Requests for Quotaticn (RFQs) in the Commerce Business Daily as well as through the mail tc marketing representatives of the major carriers. The winner is determined, as in any cther contract, based on the quote provided by the carrier and cther factors which are weighted by the contracting office. Sc far only two bases have obtained services by this methcd; Kelly Air Force Base, Texas and Tinker Air Force Base, Oklahoma. Kelly Air Force Base replaced ten WATS lines (Service Area 5) and one intrastate Texas WATS line with 14 MCI WATS DALs in August 1983. As a result of

this change Kelly Air Force Base is spending less money for more circuits (and more capability since all of the MCI DALs are capable of completing calls within Texas) and the quality of the circuits is comparable to that had previously.[44]

The Navy is also getting underway with several activities in the San Diego area recently competitively procuring SCC services. While there is no Navy-wide guidance on obtaining SCC services, the Western Division of the Naval Facilities Engineering Command requires a minimum of three quotes from competing carriers.

Apparently not willing to accept the experience of other test areas, the Army plans to competitively procure SCC services to conduct its own test at an Army activity in the metropolitan St Louis area within the next several months. The Army is the slowest of the military services to implement SCC service usage.

Another method of procurement is for the base telecommunications manager to obtain the carriers' tariffs and other information describing their services and to perform his/her own evaluation to determine the least expensive and the best (or maybe a combination of both). This is the method used by the Defense Telephone Service-Washington (DTS-Washington). DTS-Washington first obtained MCI DALs in May 1979. Currently DTS-Washington has 102 MCI Network-only DALS, 209 WATS (Service Area 6) lines, and 65 FX lines for completing long distances calls.[45] This second method is reasonable since all of the carriers are tariffed and the

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[44]Another Air Force installation, Offutt Air Force Base, is "testing" one DAL from both MCI and GTE Sprint--not an effective way, in the author's opinion, to test either cost savings or quality of service.

[45]DTS-Washington provides all administrative telephone service to all DoD components in the Washington, DC area. All long distance calls by DoD offices in the Washington, DC area are routed through the DTS-Washington electronic switch for least cost routing.

base telecommunications manager is capable of comparing rates and services. (In a sense, this method is competitive, too.) Thirty days is the standard minimum length of service required by the SCCs, so, unlike long term agreements, the risk in trying their services is minimal.

A third method is just to continue to allow AT&T to provide the service without regard to any competing carriers. This is by far the easiest method, but this method should become obsolete at all but the locations where there are no competing carriers.

3. Where to Go for Military Service Guidance and/or Assistance

Base telecommunications managers interested in obtaining SCC services should contact the appropriate office listed below for guidance and/or assistance.

Army

7th Signal Command/CCN-CPS-PL
Ft Ritchie, MD 21719

Navy[46]

Commanding Officer
Northern Division
Naval Facilities Engineering Command
Philadelphia, PA 19112

Commanding Officer
Chesapeake Division
Naval Facilities Engineering Command
Washington Navy Yard
Washington, DC 20390

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[46]Responsibility for local telephone service at Naval installations will be changing hands from the Naval Facilities Engineering Command to the Commander, Naval Telecommunications Command, 4401 Massachussetts Avenue, N.W., Washington, DC 20390 in October 1984.

Commander
Atlantic Division
Naval Facilities Engineering Command
Norfolk, VA 23511

Commanding Officer
Southern Division
Naval Facilities Engineering Command
P.O. Box 10068
Charleston, SC 29411

Commanding Officer
Western Division
Naval Facilities Engineering Command
San Bruno, CA 94066

Commander
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860

Air Force

CCD/PKZ
Griffiss AFB, NY 13441

D. SUMMARY

As has been presented in this chapter, SCC services appear like and function similar to AT&T MTS and WATS. There is sufficient evidence both inside and outside of the Department of Defense that shows that SCCs provide as good quality services which can be less expensive than those provided by AT&T. There should be no more need for testing SCC services. The military services must establish policies and provide direction to base telecommunications managers to begin the process of evaluating and, where feasible, procuring SCC services.

IV. ANALYSIS OF ALTERNATIVES

Having presented discussions in earlier chapters about the history of SCCs and the services they offer, this chapter provides, first, a general outline of questions which can be used in analyzing the use of SCC services at military installations.[47] Then, an actual case study is presented which evaluates the potential use of MCI and GTE Sprint services at Naval Air Station (NAS) Moffett Field, California. The final section of this chapter describes a computer program which was developed by the author for use in calculating the costs of using SCC dial access and dedicated access services from actual telephone bill data.

A. EVALUATING THE POTENTIAL USE OF SCC SERVICES

The first step that a base telecommunications manager must take to evaluate his/her installation for potential use of SCC services is to know what type of services the installation has and what the costs are for these services.[48] It is difficult to assess replacing or augmenting services without first knowing what is already in use. The next step is to determine if the installation is in an area served by an SCC. Do any of the SCCs have a switch serving this area or could the installation access SCC networks in a nearby city via an FX line or DAL? (Tables IV, V, VI, VIII, and IX show the origination cities for accessing the MCI and GTE

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[47]This rationale can also be used to evaluate the potential use of reseller services, but since this thesis is about SCCs that exercise is left to the reader.

[48]This first step is useful even if there are no SCCs which offer services in the area (which is to be determined in the next step) as it will help the base telecommunications manager to see if there are other services offered by the incumbent carrier which may be cost saving.

Sprint networks.)[49] If not, there is no reason to continue the evaluation at this time, but considering the way that the SCCs are growing, a periodic re-evaluation is absolutely necessary. However, a base telecommunications manager should be skeptical about planned or projected SCC service in his/her area since a "projected" availability of service is never a sure thing until it actually becomes available.

Next the base telecommunications manager must answer the question, "What is the cost of accessing the SCC network?" Does the installation have a per call per minute charge (measured service or zone usage measurement service or other usage sensitive billing)? This charge will apply each time the local access number is called (for off-network access) **in addition to the long distance charges**. In fact, all calls which result in the SCC dial tone but result in a busy signal or otherwise uncompleted call will also incur these charges.[50] These costs are real and must be kept in mind in the evaluation. If the local access number is off an exchange in a nearby city, what will an FX line cost? What are the costs for a DAL to connect directly to the SCC network? Will installing DAIs permit removal of dial 9 trunks and, as a result, save the cost of these trunks? If local lines can be removed when installing FX lines or DALs these savings should be considered.

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[49]If the specific location being evaluated is not listed, perhaps it is considered a part of a larger nearby city. For example: NAS Moffett Field is in Mountain View, Califcrnia which is not listed in the SCC network lists of cities, but Palo Alto and San Francisco are.

[50]Self estimates that an **additional** 45 percent of the actual long distance connect time must be added to calls made during the Business Day rate period to account for these uncompleted long distance calls (as well as the time required to input the access code and telephone number to be called, the time spent waiting while ringing, etc.) [Ref. 46].

The next step is to determine if there is an economic advantage[51] (cost savings) by using SCC services for completing either all[52] or part[53] of the long distance calls placed by the military installation. First, what are the calling trends of the installation? (This may lead to some other considerations such as: calls placed to or near military installations that could be placed over AUTOVON; recurrent, periodic abuse; sufficient calls to nearby cities which may warrant considering installing an FX line other than to access the SCC network.) Second, what would it cost to complete the installation's long distance calls via the SCC services? Then, assuming that the cost of completing calls via the SCC is less than the existing method(s), is the cost of accessing the SCC's service (whether dial or dedicated) less than the difference?

Lastly, the base telecommunications manager must answer the question, "Are there any technical considerations that might affect the potential use of SCC services?" For example, can the installation's PBX accomodate additional trunks? To effectively use an SCC's network-only dedicated access service, least cost routing should be considered. Is least cost routing available on the PBX? A summary of these questions is listed in Table X.

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[51]The computer program described in the following section of this chapter and which is listed in Appendix G can be very useful in this part of the evaluation.

[52]Can all of an installation's long distance calling needs be met solely by an SCC? In certain situations, yes. These situations are where no international, person-to-person, collect, third number, etc. calling is required. But as long as AT&T provides MTS service with no monthly service charges and no monthly minimums there is no reason not to have it handy just in case it's needed.

[53]If SCC services are used to supplement rather than replace existing WATS or dedicated access service, the base telecommunications manager should be aware that the hours which are shifted from the existing service are those hours which are in the lowest rate category. In other words, if 40 hours out of 120 hours per access line are shifted to another service, the 40 hours being shifted are those hours which were being charged at the over 80 hour rate.

TABLE X

Evaluating the Potential Use of SCC Services

- What type of long distance telephone services does the installation have, and what are the costs of these services?
- Does the SCC (or SCCs) have a switch serving this area or could the installation access the SCC network in a nearby city via an FX line or DAL?
- What is the cost of accessing the SCC network?
- Does the installation have a per call per minute charge (usage sensitive pricing--measured service or zone usage measurement service or other usage sensitive billing)?
- If the local access number is off an exchange in a nearby city, what will an FX line cost?
- What are the costs for a DAL to connect directly to the SCC network?
- Will installing DALs permit removal of dial 9 trunks, and as a result save the cost of those trunks?
- What are the calling trends of calls from the installation?
- What would it cost to complete the installation's long distance calls via the SCC services?
- If the cost of completing long distance calls via the SCC is less than the existing method(s), is the cost of accessing the SCC service less than the cost difference?
- Are there any technical considerations that might affect the potential use of SCC services?

B. A CASE STUDY OF NAS MOFFETT FIELD

The following case study evaluating the potential use of SCC services at NAS Moffett Field, California is provided to assist a base telecommunications manager in performing a similar analysis at his/her installation.

1. Type and Cost of Long Distance Service at NAS Moffett Field

NAS Moffett Field is located in Mountain View, Califcrnia which is in the metropolitan San Francisco area and is served by all of the majcr SCCs. The two biggest SCCs, MCI and GTE Sprint, were investigated as potential providers of long distance telephone service at NAS Moffett Field.

NAS Moffett Field has what is referred tc as POTS--Plain Old Telephone Service. No WATS lines.[54] Nc tie lines. Nc FX lines. Nothing fancy or exotic. Just MTS. Just POTS.

NAS Moffett Field is charged for zcne usage measurement service for calls in the local area.[55] The bill for long distance and zone usage measurement (ZUM) services is about $15,000 per month.

2. Cost of Accessing the SCC Network

The MCI and GTE Sprint local access numbers for NAS Moffett Field are Zone 1 calls (to Palo Alto, California). Calls to these networks (through dial access) would incur a ZUM charge cf $.03 per minute for the first minute and $.01 per minute for each additicnal minute during the Business Day rate period.[56] That's $.07 for a five minute call during

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[54]In June 1983 Pacific Telephone reccmmended installation cf twc interstate WATS lines (service area 5) and three intrastate WATS lines (twc statewide WATS lines and cne Northern California WATS line). On 24 January 1984 NAS Moffett Field had the recommended number of lines installed. Since the telephone bill data being used for the case study is pre-WATS, this discussion will proceed as if they weren't installed.

[55]ZUM calls are local calls (within 16 miles) which are billed in zones with Zone 1 being the area closest tc the location where the call was originated. Zone 1 calls are lumped tcgether and appear on the monthly bill as totals for first and additicnal minutes in each rate period. Each Zcne 2 and Zcne 3 call is itemized.

[56]There is a 30 percent discount for calls made during

the business day just to connect to the SCC network, not to make the long distance call itself. Table XI compares the cost of a five minute call to the East Coast from Moffett Field via AT&T MTS, MCI Execunet, and SPRINT.

Since calls to the MCI Execunet and SPRINT networks are Zone 1 calls, FX lines need not be considered. The proximity of Moffett Field to the SCC switches permits easy installation of SCC DALs. Not considering installation charges or monthly usage minimums, an MCI Network-only DAL would cost $85 per month, an MCI WATS DAL would cost $100 per month, and a Direct Sprint DAL would cost $100 per month (from Table VII). Moffett Field is billed $.70 per month per each base telephone number for dial 9 trunks. This charge is independent of the number of trunks, therefore, the use of DALs will not affect this charge.

TABLE XI

Cost of a Five Minute Call from NAS Moffett Field to East Coast (Including Cost to Access SCC Network)

Carrier	Cost
AT&T MTS (Current Rates)	$2.70
AT&T MTS (Proposed Rates)	$2.45
MCI Execunet (Network City)	$2.23
SPRINT (Network City)	$2.32*

*Includes 8% discount for total bill $200 or over.

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the Evening rate period, and a 60 percent discount for calls made during the Night and Weekend rate period. The rate periods for ZUM calls are the same as in Table II except the Night and Weekend rate period includes all day Sunday.

3. Calling Trends of NAS Moffett Field

The total cost of the installation's long distance and ZUM calls for the period between 20 September 1983 and 20 October 1983 was $17,990.16. There were 15,117 long distance calls at a total cost of $15,045.06. Of these calls, 1583 were interstate calls at a cost of $3424.02, nine were international calls (including to Canada) at a cost of $64.85, and the remainder were long distance calls within the state of California (1267 inter-LATA and 12,216 intra-LATA calls). The majority of Moffett Field's long distance calls are made to the eastern United States, primarily to Washington, DC, Maryland, Virginia, and New York, and, of course, within the state of California. There is also a need to call Hawaii and Alaska from Moffett Field.

4. Cost to Complete NAS Moffett Field's Long Distance Calls via SCCs

The computer program in Appendix G was used to analyze the cost of completing Moffett Field's interstate long distance calls. Twenty-one of the 1593 interstate calls were not used in the analysis because they were multiple rate period or operator assisted calls. The original cost of the remaining 1562 calls was $3348.41.

a. Dial Access Services

The costs calculated for placing these calls via AT&T MTS (proposed rates), MCI Execunet, and SPRINT are listed in Table XII. This table shows that, even (partially) considering the costs of calls to access the SCC networks, there is a significant potential cost savings by using SCC dial access services.

TABLE XII

Calculated Costs for Interstate Long distance Calls via Dial Access Services

Service	Cost	Percent Savings over AT&T MTS
Original AT&T MTS	$3348.41	-----
AT&T MTS (Proposed Rates)	$3010.79	10.1%
*MCI Execunet	$2655.92	20.7%
*MCI Execunet plus Cost of Call to Access	$2745.62	18.0%
SPRINT	$2686.04	19.8%
SPRINT plus Cost of Call to Access	$2776.73	17.1%

*Does not include eight calls to Alaska (134 minutes).

b. A Method of Estimating the Number of WATS lines or DALs Needed

The following paragraphs describe a method of estimating the number of WATS lines or DALs that may be needed.

An Erlang, a unit used to measure telephone traffic, is expressed in units of call hours per hour. An Erlang is related to CCS (hundred call seconds), another unit of traffic measurement, by a factor of 36 (1 Erlang = 36 CCS). (There are 3600 call seconds (36 CCS) in one hour.) A single telephone circuit can be in use a maximum of 1 Erlang (1 call hour per hour or 100 percent in use). The Erlang B equation is:

$$B = \frac{E^{N} / N!}{1 + E + E^{2} / 2! + \ldots + E^{N} / N!},$$

where B is the probability that N trunks are simultaneously busy with a traffic load of E Erlangs. B is also referred to as the grade of service as it can be viewed as an expression of how many calls out of 100 are not completed. For example, a B value of 0.05 means that five out of 100 calls are blocked, or there is a five percent probability that all trunks will be in use at any one moment in time. [Ref. 47]

To approximate the number of WATS lines or DALs that may be required if the total minutes of calling which occur during the busy hour is known:

1. Divide this number by 60 to obtain hours of calling in the busy hour. This value is in the same units as Erlangs.

2. Look up the value closest to this in the Erlang B tables found in Appendix F and read the required number of trunks for the desired grade of service.[57]

To calculate an approximation of the total minutes of calling in the busy hour and the number of WATS lines or DALs that may be required:

1. Take the total number of minutes of calling during the Business Day rate period for a month.
2. Divide this number by 60 to obtain hours of calling.
3. Divide the result by 22 (average number of business days in one month) to obtain average hours of calling per business day.
4. Multiply this number by .17 (an approximation that 17 percent of all calls made during the business day (8 hours) occur during the busy hour) to obtain hours of calling during the busy hour.[58] This value is in the same units as Erlangs.
5. Look up the value closest to this in the Erlang B tables (Appendix F) and read the required number of trunks for the desired grade of service.

An example of the second method is shown next, using the data from NAS Moffett Field's interstate calls. There were 5157 minutes of calls placed during the Business Day rate period. This is converted to hours as follows:

$$\frac{5157 \text{ minutes}}{60 \text{ minutes/hour}} = 85.95 \text{ hours.}$$

---

[57]Smith suggests that a grade of service of .005 is a typical practical value [Ref. 48]. The standard for the AUTOVCN system is a grade of service of .05 (for inward calling), but there are many installations throughout the Department of Defense with much worse grades of service. Remember that this grade of service is based on the busiest hour of usage during the day--so it represents worst case.

[58]If the base telecommunications manager feels that service is more or less peak loaded than this, the .17 can be increased or decreased. This should be changed only if the manager feels competent at traffic measurement and management.

Next, the number of hours of calling during the business day are calculated.

$$\frac{89.95 \text{ hours}}{22 \text{ bus. days/month}} = 3.91 \text{ hours/bus. day.}$$

The number of hours during the busy hour are calculated as follows:

$$3.91 \text{ hours/bus. day} \times .17 = .66 \text{ hours/busy hour. (Erlangs)}$$

One, two, three, and four lines will provide grades of service of .375, .101, .020, and .003, respectively, with .60 Erlangs of traffic during the busy hour (from Appendix F).

c. Dedicated Access Services

The costs calculated for completing Moffett Field's interstate long distance calls via AT&T WATS, MCI WATS, and Direct Sprint, based on using three access lines, are listed in Table XIII. Costs calculated for four access lines are found in Table XIV.

Tables XIII and XIV show that the SCC dedicated access services can save over 30 percent of the cost of completing the calls via AT&T MTS (current rates) and over 20 percent of the calculated cost of completing the calls via AT&T WATS (current rates). That's an impressive potential savings.

TABLE XIII

Calculated Costs for Interstate Long Distance Calls via Dedicated Access Services (Three Access Lines)

Service*	Cost	Percent Savings over AT&T MTS	Percent Savings over AT&T WATS (Current Rates)
Original AT&T MTS	$3348.41	-----	-----
AT&T WATS (Current Rates)	$2735.95	18.3%	-----
AT&T WATS (Proposed Rates)	$2260.08	32.5%	17.4%
**MCI WATS	$2111.76	36.9%	22.8%
Direct Sprint	$2145.04	35.9%	21.6%

*AT&T WATS, MCI WATS, and Direct Sprint costs are based on using three access lines which are calculated to provide a grade of service of .025 during the busy hour. The costs include the per line monthly recurring charges but not order or installation charges.

**Does not include eight calls to Alaska (134 minutes).

TABLE XIV

Calculated Costs for Interstate Long Distance Calls via Dedicated Access Services (Four Access Lines)

Service*	Cost	Percent Savings over AT&T MTS	Percent Savings over AT&T WATS (Current Rates)
Original AT&T MTS	$3348.41	-----	-----
AT&T WATS (Current Rates)	$2810.20	16.1%	-----
AT&T WATS (Propcsed Rates)	$2350.63	29.8%	16.4%
**MCI WATS	$2238.11	33.2%	20.4%
Direct Sprint	$2243.91	33.0%	20.2%

*AT&T WATS, MCI WATS, and Direct Sprint costs are based on using four access lines which are calculated to provide a grade of service of .004 during the busy hour. The ccsts include the per line monthly recurring charges but nct crder or installation charges.

**Dces nct include eight calls to Alaska (134 minutes).

d. Intrastate Calling

Although this case study was oriented toward evaluating the costs of completing interstate calls via MCI and GTE Sprint services, intrastate calls could be completed via these services as well. As stated in the previous chapter, MCI will complete calls within the state (California) only if they terminate on their network, and GTE Sprint will complete all calls within the state. Pacific Bells's rates for intrastate calls are such that nearly all calling to locations more than 40 miles away is less expensive via MCI Execunet, MCI Network Service (without Universal Termination), SPRINT, or Direct Sprint (to network cities). For Direct Sprint to non-network cities, the distance must be greater than 110 miles before a call is less expensive than via Pacific Bell.[59] Therefore, at Moffett Field most intra-LATA calls would probably be less expensive to complete via Pacific Bell[60] and inter-LATA calls would be less expensive via the SCCs.[61]

Exactly how much can be saved by completing intrastate calls via SCCs was not determined. It is reasonable to assume that some cost savings would result but, unless the installation has (or can obtain) least cost routing, the telephone user would have too many decisions to make for completing a call.

---

[59]These comparisons are based on a five minute call during the Business Day rate period and, for MCI Network Service and Direct Sprint, an average use per line in the Business Day rate period of less than 900 minutes.

[60]For many installations, some intra-LATA calls will be less expensive if placed via the SCCs since some locations within the LATA may be rather distant.

[61]A semi-random inspection of the inter-LATA calls on Moffett Field's telephone bill showed that about 70 percent of these calls could be completed on MCI's network.

5. Technical Considerations

The Centrex system at Moffett Field has room for additional trunk terminations and least cost routing is available (for a price, of course) if the installation desires to take advantage of this capability to make the routing choices for the telephone user. There are no other known technical considerations at NAS Moffett Field.

C. A COMPUTER PROGRAM USED TO CALCULATE COSTS OF USING SCC SERVICES

The computer program in Appendix G was created by the author to analyze the costs of completing interstate calls via AT&T MTS and WATS (at current and proposed tariff rates), MCI Execunet and MCI WATS, and SPRINT and Direct Sprint. A description of this program is given below.

1. Computer Program Description

Basically, this program takes telephone bill data and calculates the cost of each call as if it were made via AT&T (with current and proposed rates), MCI, and GTE Sprint. It was written for interactive computing using the WATFIV facilities of the IBM 3033 at the Naval Postgraduate School.

Files containing listings of area codes and prefixes that are on the MCI and GTE Sprint networks are read into an array. This permits comparison with the area code and prefix of a telephone call (from the input data) to determine if that area code and prefix are on the SCC networks.

Telephone bill data for a one month period is read from a file[62] into an array (actually several arrays) and

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[62]The format of the telephone call data in the input file was arbitrarily chosen since the data used for the case study in the previous section of this chapter was entered manually from the telephone bill. The computer program can easily be modified to accept data from magnetic tapes. (After obtaining and processing three magnetic tapes with

sorted by area code and prefix to permit a readable output, if output is requested for each call. Data for calls outside of the United States (all 50 States and the District of Columbia), in multiple rate periods, or in a rate class other than direct dial (i.e., person-to-person, station-to-station, collect, third party, etc.) is automatically rejected.

The program calculates the distance (actually a range of distances) to the called number for each call from the duration, rate period, and cost of the call.[63] Data for calls for which the distance calculation does not properly calculate a distance is also rejected.

Costs of completing each call via AT&T MTS (proposed rates), MCI Execunet, and SPRINT are calculated based on the duration, rate period, distance (range of distances) to called number, and, for MCI Execunet, whether it is a network or non-network call. Also, the minutes of calls which occur within each rate period to network and non-network locations are summed for use in calculating the WATS and dedicated access services costs. This program will account for the cost of a call to access MCI Execunet and SPRINT, based on first minute and additional minute rates. Costs for each individual call are calculated and can be output, if the user desires. The results can be output as total costs for all calls or the costs of each call can be output individually followed by total costs for all calls. Figure 4.1 shows the interactive queries and responses which produced the ouput shown in Figure 4.2.

---

only a handful of calls on each, the author resorted to the manual input method. The author **highly** recommends inputting the telephone bill data from magnetic tape.)

[63]Common carriers actually calculate the distance to the called number from the coordinates of the calling and called locations, requiring a very large data base.

```
DO YOU WANT OUTPUT FOR EACH CALL? (Y OR N)

Y  WILL GIVE DATA FOR EACH CALL PLUS TOTALS
N  WILL GIVE TOTALS ONLY
Y

IS THERE A CHARGE FOR THE CALL TO ACCESS
THE MCI EXECUNET AND SPRINT NETWORKS?
            (Y OR N)
Y

THIS PROGRAM ASSUMES:
* MCI AND SPRINT LOCAL ACCESS NUMBERS ARE
  IN THE SAME AREA

* THE COST OF ACCESS IS BASED ON A FIRST
  MINUTE RATE AND AN ADDITIONAL MINUTE RATE

* THE RATE PERIODS ARE AS FOLLOWS:
-------------------------------------------
BUSINESS DAY
 8AM TO BUT NOT INCLUDING  5PM  MON-FRI
-------------------------------------------
EVENING
 5PM TO BUT NOT INCLUDING 11PM  SUN-FRI
-------------------------------------------
NIGHT AND WEEKEND
11PM TO BUT NOT INCLUDING  8AM  ALL DAYS
 8AM TO BUT NOT INCLUDING 11PM    SAT
 8AM TO BUT NOT INCLUDING  5PM    SUN
-------------------------------------------

DO YOU STILL WANT TO CONTINUE TO ENTER DATA
FOR CALCULATING THE COST OF ACCESSING THE
SCC NETWORKS?          (Y OR N)

Y  WILL CONTINUE AND ASK FOR RATES
N  WILL PREVENT CALCULATON OF ACCESS COSTS
Y

FOR THE DAY RATE PERIOD:

WHAT IS THE FIRST MINUTE RATE?
(EXAMPLE: FOR $.03 PER MINUTE INPUT .03)
.03

WHAT IS THE ADDITIONAL MINUTE RATE?
(EXAMPLE: FOR $.01 PER MINUTE INPUT .01)
.01

ARE THE CHARGES FOR THE OTHER RATE PERIODS
CALCULATED AS A PERCENTAGE OF THE DAY RATE?
            (Y OR N)
Y

WHAT IS THE DISCOUNT FOR THE EVENING RATE
PERIOD? (GIVE AS A REAL FRACTION.
EXAMPLE: FOR A 30% DISCOUNT INPUT .3)
.3
```

Figure 4.1 Interactive Computer Queries and User Responses.

```
WHAT IS THE DISCOUNT FOR THE NIGHT AND
WEEKEND RATE PERIOD? (GIVE AS A REAL
FRACTION. EXAMPLE: FOR A 60% DISCOUNT
INPUT .6)
.6

FOR CALCULATING THE AT&T WATS COSTS USING
CURRENT RATES, WHAT IS THE RATE STEP?
(THIS IS THE RATE STEP FOR SERVICE AREA 6)

RATE
STEP                STATES
-------------------------------------------
 19  -  ID, OR, WA
-------------------------------------------
 20  -  AZ, CA, MT, NV, UT
-------------------------------------------
 21  -  AR, CO, IL, IN, IA, KS, LA, MI, MN,
        MO, NE, NM, ND, OK, SD, TX, WI, WY
-------------------------------------------
 22  -  AL, CT, DE, DC, FL, GA, KY, ME, MD,
        MA, MS, NH, NJ, NY, NC, OH, PA, RI,
        SC, TN, VT, VA, WV
-------------------------------------------

INPUT RATE STEP (19, 20, 21, OR 22)
20

FOR CALCULATING THE AT&T WATS COSTS USING
PROPOSED RATES, WHAT IS THE RATE STEP?

RATE
STEP                STATES
-------------------------------------------
 14  -  IA, KS, NE
-------------------------------------------
 15  -  AR, IL, MN, MO, ND, OK, SD
-------------------------------------------
 16  -  CO, IN, LA, MS, TX, WI, WY
-------------------------------------------
 17  -  AL, KY, MI, MT, NM, OH, TN
-------------------------------------------
 18  -  AZ, CA, CT, DE, DC, FL, GA, ID, ME,
        MD, MA, NV, NH, NJ, NY, NC, OR, PA,
        RI, SC, UT, VT, VA, WA, WV
-------------------------------------------

INPUT RATE STEP (14, 15, 16, 17, OR 18)
18
```

Figure 4.1 (Continued) Interactive Computer Queries and User Responses.

```
FOR CALCULATING THE DIRECT SPRINT COSTS,
WHAT IS THE REGION OF ORIGINATION?

REGION            STATES
-----------------------------------------
  1  -  CO, GA, IL, LA, MO, OH, TX, WI
-----------------------------------------
  2  -  AZ, CA, DC, FL, MA, MD, NC, NY,
        PA, WA
-----------------------------------------

(NOTE: ONLY SPECIFIC LOCATIONS IN THESE
STATES ARE CAPABLE OF DIRECT SPRINT CALL
ORIGINATION)

INPUT REGION (1 OR 2)
2

BASED ON  0.66 ERLANGS DURING THE BUSY
HOUR THE FOLLOWING NUMBERS OF LINES WILL
GIVE THE FOLLOWING GRADES OF SERVICE.
(EXAMPLE: GRADE OF SERVICE = 0.050 MEANS
5 OUT OF 100 ATTEMPTED CALLS ARE NOT
COMPLETED.)

NUMBER OF LINES =   2   GRADE OF SERVICE = 0.117
NUMBER OF LINES =   3   GRADE OF SERVICE = 0.025
NUMBER OF LINES =   4   GRADE OF SERVICE = 0.004

HOW MANY TOTAL WATS LINES OR DEDICATED
ACCESS LINES DO YOU WANT TO USE TO
CALCULATE DEDICATED ACCESS SERVICE COSTS?

(A RESPONSE OF 999 WILL ALLOW CALCULATION
OF COSTS FOR A RANGE OF NUMBERS OF LINES)
999

WHAT IS THE SMALLEST NUMBER IN THE RANGE OF
NUMBERS OF LINES?
1

WHAT IS THE LARGEST NUMBER IN THE RANGE OF
NUMBERS OF LINES?

(MUST BE WITHIN 10 LINES OF THE SMALLEST)
4
```

Figure 4.1 (Continued) Interactive Computer Queries and User Responses.

RATE PERIOD: 1 = DAY 2 = EVENING 3 = NIGHT AND WEEKEND

****

AREA CODE 201

****

PREFIX 234

MINUTES	RATE PERIOD	PLACE		ORIG AT&T COST	NEW AT&T COST	MCI COST	MCI PLUS ACCESS COST	SPRINT COST	SPRINT PLUS ACCESS COST
2	2	PEAPACK	NJ	0.73	0.69	0.58	0.60	0.55	0.57
PREFIX 245									
3	1	ROSELLE	NJ	1.72	1.59	1.30	1.35	1.38	1.43
PREFIX 265									
1	1	ORADELL	NJ	0.74	0.73	0.43	0.46	0.56	0.59
5	1	ORADELL	NJ	2.70	2.45	2.16	2.23	2.20	2.27
PREFIX 267									
1	1	MORRISTOWN	NJ	0.74	0.73	0.43	0.46	0.56	0.59
PREFIX 284									
3	1	NUTLEY	NJ	1.72	1.59	1.30	1.35	1.38	1.43
2	1	NUTLEY	NJ	1.23	1.16	0.86	0.90	0.97	1.01

.
.
.

Figure 4.2 An Example of the Computer Program Output.

```
.
.
.
TOTAL CALLS =  1562
TOTAL MINUTES =      7825 MINUTES
AVERAGE TIME PER CALL =    5.0 MINUTES PER CALL
NUMBER OF CALLS REJECTED =  21

ORIGINAL TOTAL AT&T MTS COST = $    3348.41
AVERAGE COST PER MINUTE = $ 0.428

TOTAL AT&T MTS COST (PROPOSED RATES) = $    3010.79
AVERAGE COST PER MINUTE = $ 0.385

TOTAL MCI EXECUNET COST = $    2655.92
AVERAGE COST PER MINUTE = $ 0.345
  8 CALLS UNABLE TO BE COMPLETED (TO ALASKA)  (MINUTES =    134)

TOTAL MCI EXECUNET COST (WITH COST OF CALL TO ACCESS) = $    2745.62
AVERAGE COST PER MINUTE = $ 0.357
  8 CALLS UNABLE TO BE COMPLETED (TO ALASKA)  (MINUTES =    134)

TOTAL SPRINT COST = $    2686.04
AVERAGE COST PER MINUTE = $ 0.343

TOTAL SPRINT COST (WITH COST OF CALL TO ACCESS) = $    2776.73
AVERAGE COST PER MINUTE = $ 0.355


BASED ON  0.66 ERLANGS DURING THE BUSY HOUR THE FOLLOWING
NUMBER OF LINES WILL GIVE THE FOLLOWING GRADES OF SERVICE.
(EXAMPLE: GRADE OF SERVICE = 0.050 MEANS 5 OUT OF 100
ATTEMPTED CALLS ARE NOT COMPLETED.)


NUMBER OF LINES =   2    GRADE OF SERVICE = 0.117
NUMBER OF LINES =   3    GRADE OF SERVICE = 0.025
NUMBER OF LINES =   4    GRADE OF SERVICE = 0.004
```

Figure 4.2 (Continued) An Example of the Computer Program Output.

```
RATE STEP USED FOR AT&T WATS (CURRENT RATES) CALCULATION =  20
RATE STEP USED FOR AT&T WATS (PROPOSED RATES) CALCULATION =  18
REGION USED FOR DIRECT SPRINT CALCULATION =  2


TOTAL NUMBER OF WATS LINES OR DEDICATED ACCESS LINES =   1


TOTAL AT&T WATS COST (CURRENT RATES) = $   2433.76
AVERAGE COST PER MINUTE = $ 0.311

TOTAL AT&T WATS COST (PROPOSED RATES) = $   1957.53
AVERAGE COST PER MINUTE = $ 0.250

TOTAL MCI WATS COST = $   1811.11
AVERAGE COST PER MINUTE = $ 0.235
  8 CALLS UNABLE TO BE COMPLETED (TO ALASKA) (MINUTES =   134)

TOTAL DIRECT SPRINT COST = $   1881.80
AVERAGE COST PER MINUTE = $ 0.240


TOTAL NUMBER OF WATS LINES OR DEDICATED ACCESS LINES =   2


TOTAL AT&T WATS COST (CURRENT RATES) = $   2644.80
AVERAGE COST PER MINUTE = $ 0.338

TOTAL AT&T WATS COST (PROPOSED RATES) = $   2156.20
AVERAGE COST PER MINUTE = $ 0.276

TOTAL MCI WATS COST = $   1984.41
AVERAGE COST PER MINUTE = $ 0.258
  8 CALLS UNABLE TO BE COMPLETED (TO ALASKA) (MINUTES =   134)

TOTAL DIRECT SPRINT COST = $   2045.53
AVERAGE COST PER MINUTE = $ 0.261
```

Figure 4.2 (Continued) An Example of the Computer Program Output.

```
TOTAL NUMBER OF WATS LINES OR DEDICATED ACCESS LINES =    3

TOTAL AT&T WATS COST (CURRENT RATES) = $    2735.95
AVERAGE COST PER MINUTE = $ 0.350

TOTAL AT&T WATS COST (PROPOSED RATES) = $    2260.08
AVERAGE COST PER MINUTE = $ 0.289

TOTAL MCI WATS COST = $    2111.76
AVERAGE COST PER MINUTE = $ 0.275
  8 CALLS UNABLE TO BE COMPLETED (TO ALASKA)  (MINUTES =    134)

TOTAL DIRECT SPRINT COST = $    2145.04
AVERAGE COST PER MINUTE = $ 0.274


TOTAL NUMBER OF WATS LINES OR DEDICATED ACCESS LINES =    4

TOTAL AT&T WATS COST (CURRENT RATES) = $    2810.20
AVERAGE COST PER MINUTE = $ 0.359

TOTAL AT&T WATS COST (PROPOSED RATES) = $    2350.63
AVERAGE COST PER MINUTE = $ 0.300

TOTAL MCI WATS COST = $    2238.11
AVERAGE COST PER MINUTE = $ 0.291
  8 CALLS UNABLE TO BE COMPLETED (TO ALASKA)  (MINUTES =    134)

TOTAL DIRECT SPRINT COST = $    2243.91
AVERAGE COST PER MINUTE = $ 0.287
```

Figure 4.2 (Continued) An Example of the Computer Program Output.

Since charges for the dedicated access services (AT&T WATS, MCI Network Service with Universal Termination (MCI WATS), and Direct SPRINT) are based on average usage per line, the total number of WATS lines or DALs must be entered. The computer program estimates the Erlangs of call traffic during the busy hour (using the second method of approximating the number of WATS lines or DALs described in the previous section of this chapter) and displays the calculated numbers of lines and grades of service on the visual display terminal to allow the user to decide how many access lines should be used in the WATS and dedicated access services cost calculations. If the user desires, a range of numbers of access lines may be entered and calculations will be performed and results given for each number of access lines in the range of numbers. Also, if the user desires, the number of access lines which is used in the calculation can be an existing or carrier-proposed number of WATS lines or DALs or a number derived from any reliable source.

2. Computer Program Assumptions and Limitations

The following are assumptions and limitations of the program:

- This program can be used only for calculating costs of calls (via AT&T MTS and WATS, MCI Execunet and MCI WATS, and SPRINT and Direct Sprint with Universal Calling) originated within the continental United States (CONUS) and completed to CONUS, Hawaii, and Alaska. It also assumes that the user knows if the location being evaluated is in an area which permits originating calls via these services.

- Telephone bill data from a one month period is used for the input data. (The user should consider using an average month's bill and a peak month's bill to evaluate the costs and number of WATS and DALs for average and peak months of

telephone usage in order to determine if there is a significant difference.)

- Tenths of a cent are truncated from the costs calculated for each AT&T MTS call and are rounded for each MCI Execunet and SPRINT call.

- Since calls to Hawaii made via AT&T MTS are billed by Band and not by mileage (see Appendix E), the program converts Bands to mileage ranges for use in calculating the costs via the other carriers. The correctness of these conversions has not been determined except for the West Coast.

- Costs for calls made via dial access services (MCI Execunet and SPRINT) in the 56-70 and 71-124 mile distance ranges are calculated using the rates for the 71-124 mile range since AT&T MTS has only a 56-124 mile range (and the distance (range of distances) to the called number is calculated from the duration, rate period, and cost of the original AT&T MTS call).

- Costs for calls made via MCI Execunet over 3000 miles are calculated using the rates for the 1911-3000 mile range since there is no rate shown in the tariff for distances greater than 3000 miles.

- Costs for calls made via SPRINT are calculated using the rates which are discounted for over $200 usage per month.

- The program calculates the costs of accessing the dial access services, if any, using first minute and additional minute rates, the rate periods in Table II, and only the duration of the completed long distance call.

- Since original call data is in one minute increments, WATS and dedicated access service cost calculations do not

consider the less than one minute increments used by these carriers or the one minute minimum average time requirement of these carriers.

- WATS and dedicated access service cost calculations include the monthly recurring charges per access line but not order or installation charges. The monthly recurring charges used in the program are the basic charges which assume that the installation is close enough to the carrier's point of termination so as to avoid additional mileage charges.

- Costs for AT&T WATS (current tariff) are calculated using Service Area 6 rates. The rates used for calculating costs of AT&T WATS (proposed tariff) are for Service Areas 5 and 6 (which have the same rates).

- The program does not round the total hours of calls in each rate period to the nearest tenth of an hour for AT&T WATS cost calculations.

- Costs are calculated for dedicated access services with "Universal Termination" (MCI WATS and Direct Sprint with Universal Calling), and not for network-only termination service.

V. SUMMARY AND RECOMMENDATIONS

A. SUMMARY

1. Specialized Common Carriers--A History

Following an introductory chapter, the second chapter of this thesis presents a brief history of Specialized Common Carriers (SCCs). Several Federal Communications Commission (FCC) actions were particularly significant in preparing the way for SCCs; the 1959 and 1960 **Above** 890 decisions, the 1968 **Carterfone** decision, the 1969 **MCI** decision, and the 1971 **Specialized Common Carrier** decision.

The **Above** 890 decisions opened the microwave field to private firms and individuals allowing them to install microwave systems utilizing the frequency spectrum above 890 MHz for their own use. Since the FCC prohibited sharing facilities and systems, this decision did not allow competition with established common carriers.

The **Carterfone** decision required the Bell System to permit interconnection of non-Bell equipment as long as the interconnection would not harm the system or disrupt the ability of others to use the system.

In 1963, Microwave Communications, Incorporated (MCI) applied for FCC certification for public common carrier point-to-point microwave service between Chicago and St Louis and intermediate points. After several years, and in spite of vigorous opposition by AT&T, General Telephone, Illinois Bell, Southwestern Bell, and Western Union, the FCC approved this application in 1969 in what is called the **MCI** decision.

By 1971 there were applications on file with the FCC for 1,977 microwave stations in 46 separate proposals from 33 new carriers. To avoid reviewing each of these applications individually, the FCC opened the SCC field to open competition in their June 1971 Specialized Common Carrier decision.

While SCCs continue to offer private line point-to-point service, which is what the FCC Specialized Common Carrier decision originally permitted them to provide, they are now making their money by offering long distance, switched network services in direct competition with AT&T. Revenues in 1983 from the long distance services provided by MCI, GTE Sprint, and ITT United States Transmission Systems (USTS) totaled $2.44 billion, seven percent of AT&T's $35 billion. Analysts predict that this may increase to 10 to 20 percent of a more than $100 billion per year industry by 1990.

2. Specialized Common Carrier Switched Voice Network Services

Chapter III describes MCI and GTE Sprint dial access and dedicated access services, discussing the costs, additional features, advantages, and disadvantages of these services. Dial access service is similar to AT&T's MTS (without operator assistance). A customer dials a local access (telephone) number and a billing code to access the SCC, and, finally, the desired number to be called. Calls via MCI Execunet and GTE Sprint's SPRINT can be originated only in a limited, but large and growing, number of locations. Both services offer "Universal Termination" which permits completing calls to non-network cities. Billing is based on the duration of the call, rate period, distance to called number, and whether to a network or non-network city. MCI and GTE Sprint offer least cost routing, group billing,

speed dialing, travel/credit card service, and magnetic tape billing as additional features with their dial access services.

Dedicated access service is the SCC's marketing answer to AT&T's WATS. The customer accesses the SCC network through a dedicated access line (DAL), eliminating the need to dial the local access number or billing code. Again, calls via these services can be originated only from specific areas. MCI Network Service and Direct Sprint allow calling only to network cities, while calls made via MCI Network Service with Universal Termination (MCI WATS) and Direct Sprint with Universal Calling can be completed to non-network cities. Both companies bill their dedicated access services based on average use per line per rate period to network or non-network cities. Also, both have a one minute minimum average time requirement. Least cost routing, accounting codes, and magnetic tape billing are additional features offered with these services.

While SCCs are interstate carriers, the AT&T divestiture agreement mandated that long distance service between LATAs would be provided by AT&T and other carriers like the SCCs. So far, SCCs have been authorized to offer (at least partial) intrastate calling in six states. Potential SCC users must check with the SCCs concerning their service offerings in a particular state.

SCC use throughout the Department of Defense is currently limited to just a handful of places. The Department of Defense should be concerned because there is money to be saved. According to MCI:

> ...While we have been unable to obtain an accurate figure for DoD's current cost for [administrative long distance telephone services,] estimates place these costs at a minimum of $500 million annually. The potential savings may be as high as $125 million annually....

One method, of several being used (on a very limited basis) in the Department of Defense to procure SCC services, is through a strictly competitive procurement process. Using this method, Kelly Air Force Base, Texas replaced ten WATS lines (Service Area 5) and one intrastate WATS line with 14 MCI WATS DALs in August 1983. As a result of this change Kelly Air Force Base is spending less money for more circuits (and more capability since all of the MCI DALs are capable of completing calls within Texas) and the quality of the circuits is comparable to that had previously.

Another method is for the base telecommunications manager to obtain the carriers' tariffs and other information describing their services and to perform his/her own evaluation to determine the least expensive and best carrier.

A third method is just to continue to allow AT&T to provide the service without regard to any competing carriers. This method should be used only at locations where there are no competing carriers.

The offices which base telecommunications managers should contact for guidance and/or assistance on obtaining SCC services are listed in the chapter.

3. Analysis of Alternatives

Chapter IV outlines a method of evaluating the potential use of SCC services at military installations and applies this method in a case study evaluating the potential use of MCI and GTE Sprint services at Naval Air Station Moffett Field, California. Table XV is a summary of the questions that a base telecommunications manager must answer in evaluating SCC usage at his/her installation.

The case study shows a potential cost savings of about 20 percent using MCI and GTE Sprint dial access services and over 30 percent using their dedicated access

TABLE XV

Evaluating the Potential Use of SCC Services

- What type of long distance telephone services does the installation have, and what are the costs of these services?
- Does the SCC (or SCCs) have a switch serving this area or could the installation access the SCC network in a nearby city via an FX line or DAL?
- What is the cost of accessing the SCC network?
- Does the installation have a per call per minute charge (usage sensitive pricing--measured service or zone usage measurement service or other usage sensitive billing)?
- If the local access number is off an exchange in a nearby city, what will an FX line cost?
- What are the costs for a DAL to connect directly to the SCC network?
- Will installing DALs permit removal of dial 9 trunks, and as a result save the cost of those trunks?
- What are the calling trends of calls from the installation?
- What would it cost to complete the installation's long distance calls via the SCC services?
- If the cost of completing long distance calls via the SCC is less than the existing method(s), is the cost of accessing the SCC service less than the cost difference?
- Are there any technical considerations that might affect the potential use of SCC services?

services for completing long distance calls at Moffett Field. Exactly how much could be saved by completing intrastate calls via SCCs was not determined, but at Moffett Field most intra-LATA calls would probably be less expensive to complete via Pacific Bell and inter-LATA calls would be less expensive via the SCCs.

The last section of this chapter describes a computer program (in Appendix G) which was created by the

author to analyze the costs of completing interstate calls (originated within the continental United States (CONUS) and completed to CONUS, Hawaii, and Alaska) via AT&T MTS and WATS (at current and proposed tariff rates), MCI Execunet and MCI WATS, and SPRINT and Direct Sprint. Basically, this program takes telephone bill data and calculates the cost of each call as if it were made via AT&T (with current and proposed rates), MCI, and GTE Sprint. It was written for interactive computing using the WATFIV facilities of the IBM 3033 at the Naval Postgraduate School. Figures giving examples of the interactive queries and user responses and the outputted results are provided in the chapter. Assumptions and limitations of the computer program are also presented.

SCCs are rapidly growing competitors in a multi-billion dollar long distance telecommunications market. They are viable alternative long distance carriers for military installations. Several military installations are currently using SCC services and receiving excellent service at less cost than for comparable AT&T offerings. More installations must evaluate the potential use of SCC services and begin realizing the cost savings that are currently possible.

B. RECOMMENDATIONS

The Department of Defense and the Military Services must provide guidance to base telecommunications managers on procuring and using SCC services. A restatement and reemphasis of the federal government's policy on competitive procurement of local telecommunications services, including long distance services, by the Office of the Secretary of Defense is in order. Military Service regulations and instructions must state the Service's policy on the use of SCC services and provide guidance on methods of procurement.

Training on long distance alternatives should be included in base telecommunications manager training programs such as the Air Force's Basic and Staff Telecommunications Officer courses at the Keesler Technical Training Center, Keesler Air Force Base, Mississippi. Also, a primer on SCCs, such as this thesis, should be published and made available to all base telecommunications managers in the United States.

NAS Moffett Field should seriously consider using SCC services due to the significant potential cost savings that could be realized as shown by the case study.

Several thesis research topics are suggested by this study:

- Long distance resellers--history, regulation, and services.

- (Adequacy of) Department of Defense and Military Service guidance on procurement and use of telecommunications services.

- Use of microcomputers to analyze the use of SCC and/or reseller services at military installations.

- An analysis of the economic feasibility of the use of dynamic least cost routers and software defined systems.

- Additional research on the topic of this thesis to include:

  - Modifying the computer program to calculate the installation's busy hour and hours of calling during the busy hour from time of day and duration of call data. Also, use of the computer program to provide more statistical information about the installation's monthly telephone bill, i.e., total cost of calls within each area code.

  - Implementation of SCC services at an installation which has been evaluated using the computer program and

subsequent monitoring to see if the evaluation was an accurate estimation of cost savings to be realized using SCC services.

APPENDIX A

CHRONOLOGY OF SPECIALIZED COMMON CARRIERS

1959/1960 - FCC Above 890 decisions allowing private microwave systems to be developed using the frequency spectrum above 890 MHz.

1963 - MCI applied to FCC for microwave link between St Louis and Chicago.

1968 - FCC Carterfone decision allowing connection of non-Bell telephone equipment to the telephone system.

August 1969 - FCC MCI decision authorized MCI to provide private line microwave service between St Louis and Chicago.

November 1969 - Datran Transmission Co. (DATRAN) applied to FCC for microwave system linking 35 metropolitan areas with a switched circuit high-speed data network.

July 1970 - FCC staff recommended policy of open Specialized Common Carrier competition.

October 1970 - Justice Department urged FCC to adopt policy of open competition in Specialized Common Carrier field.

May 1971 - FCC Specialized Common Carrier decision opened Specialized Common Carrier field to competition.

1972 - MCI authorized by FCC to build New York to Chicago microwave link. DATRAN authorized by FCC to begin construction on its microwave system between 35 major cities.

February 1973 - Southern Pacific Communications Co. (SPC) authorized by FCC to begin building its microwave network.

July 1973 - ITT's United States Transmissions Systems, Inc. (USTS) applied to FCC to build a microwave network between New York and Houston via Philadelphia, Washington, DC, and Atlanta.

October 1973 - AT&T petitioned the FCC to stop licensing Specialized Common Carriers.

September 1974 - ITT's USTS authorized by FCC to build microwave network.

May 1975 - AT&T objected to MCI sales of long-distance type voice service with Execunet stating that it was outside the FCC authorization for MCI to provide private line service.

July 1975 - FCC ruled MCI Execunet service did not fit the definition of private-line service, which was what MCI was authorized to provide.

July 1976 - FCC reaffirmed its ruling that MCI's Execunet was not lawful.

August 1976 - DATRAN decided to end operations and filed for bankruptcy.

1976 - MCI and SPC filed with FCC to offer switched voice network services: Switched Private Line Service and SPRINT, respectively.

July 1977 - Court of Appeals reversed FCC decision on the legality of MCI's Execunet service.

1978 - ITT's USTS filed to offer switched voice network service City-Call.

October 1980 - FCC approved resale of Wide Area Telecommunications Service (WATS) by other common carriers.

June 1981 - Northwest Iowa Telephone Co. offered MCI long-distance calling to all its customers.

January 1982 - U. S. Department of Justice and AT&T agreed to drop government's 1974 anti-trust charges and 1956 anti-trust settlement barring AT&T from engaging in unregulated business. AT&T agreed to divest itself of 22 local Bell operating companies.

November 1982 - MCI announced plans to test the use of cable TV for telephone service in Omaha, Nebraska.

December 1982 - MCI bought railroad rights of way to install fiber optic cable.

February 1983 - MCI arranged to buy two satellite transponders.

June 1983 - GTE Corporation acquired SPC and formed GTE Sprint.

APPENDIX B
GLOSSARY OF TERMS

Area Code - A three digit code which precedes the NNX code or prefix and is used for calling from one geographical area to another. Also known as Number Plan Area (NPA).

Automatic Voice Network (AUTOVON) - A worldwide switched voice network used by the Department of Defense.

Busy Hour - The peak 60 minute period of telephone usage during the day.

Centrex - A PBX in which incoming calls are dialed direct to the extensions without operator assistance. Centrex CU has switching equipment on-premise with the switchboard. Centrex CO has switching equipment in the commercial telephone exchange (Central Office).

Communications Common Carrier - A company which provides communications services, or classes of communications services to the public and whose services and rates are subject to public regulation.

Dedicated (or Direct) Access Line (DAL) - A circuit connecting a phone system directly to the terminal of a long distance carrier. A WATS lines is a DAL to AT&T Long Lines.

Dial 9 Trunk - Dial Access Central Office Trunk - A direct circuit between a PBX and a telephone Central Office to which all stations have access by dialing a given digit (9).

Direct Distance Dialing - An AT&T service which permits the telephone user to dial his/her own long distance telephone calls without operator assistance.

Dual Tone Multi-Frequency (DTMF) Signalling - A signalling method which uses combinations of two frequencies to indicate telephone number digits (and precedence, in the case of AUTOVON). Also known as touch tone dialing.

Foreign Exchange Line (FX) - A trunk, paid for on a flat monthly rate, connecting a PBX to a remote telephone exchange.

Least Cost Routing - Also referred to as Automatic Route Selection (ARS) and Route Optimization - Automatic selection of the most economical route for an outgoing call.

Least Cost Routing Device - An electronic device which routes a call over the most economical telecommunications path available.

Line - A common term used to denote any circuit connecting two or more telecommunications devices.

Local Access Number - A telephone number which is dialed to access an SCC switch to make calls via the SCC's network.

Local Access and Transport Area (LATA) - A geographical area within which a telephone company may provide "local" service. There are 161 LATAs. Idaho, Maine, New Mexico, and the District of Columbia each have one LATA for the entire state or district. All other states have more than one LATA.

Message Telecommunications Service (MTS) - Long Distance Message Telecommunications Service (LDMTS) - AT&T's composite service of direct distance dialing (DDD) and operator assisted calling.

Minimum Average Time Requirement (MATR) - A requirement that the average duration of calls placed via a carrier's service must be at least a specified minimum. AT&T WATS, MCI WATS, and Direct Sprint each have a one minute minimum average time requirement.

NNX Code - The first three digits of a seven digit telephone number.

Other Common Carrier (OCC) - A communications common carrier other than AT&T.

Plain Old Telephone Service (POTS) - Ordinary long distance telephone service (AT&T MTS).

Prefix - The first three digits of a seven digit telephone number.

Private Branch Exchange or Private Automatic Branch Exchange (PBX) - A private phone system connected to the public telephone network which permits internal routing and switching of calls.

Private Line - A point-to-point circuit with no connection to a PBX or network. Usually a special circuit such as a fire or guard telephone, or a circuit used to interconnect computers.

Rotary or Pulse Dial - A signalling method which generates pulses (a pulse being defined as a single impulse of a telephone dial) to indicate telephone digits.

Service Areas - A geographical area within which AT&T WATS calls may be completed (outward WATS) or originated (inward WATS). Interstate WATS is offered in the form of six geographical areas called Service Areas (formerly Bands). Service Area 1 includes the states adjacent to the state in which the call is originated and each higher numbered Service Area adds a larger geographical area to the lower numbered Service Area(s). Service Area 5 WATS permits calling to anywhere within the continental United States (outside of the state in which the call was originated). Service Area 6 adds Alaska and Hawaii.

Specialized Common Carrier (SCC) - A communications common carrier offering telecommunications services between two or more points to large volume users.

Switched Network - A network consisting of customers or subscribers connected to switching centers (central offices) which are interconnected by a series of other switches. Rather than using a full-time physical connection between two users or locations (such as a private line), a call is completed via temporary connections between switching centers and switches.

Tariff - The published rate for a specific unit of equipment, facility, or type of service provided by a communications common carrier.

Tie Line - A direct circuit between two PBXs.

Trunk - A circuit between switchboards or PBXs or between a switchboard/PBX and a telephone Central Office.

Universal Termination - An SCC term for the capability to call any location in the continental United States and some other locations from specific cities that are on the SCC network. Sometimes referred to as Universal Calling.

Usage Sensitive Pricing - A pricing system that charges for calls based on one or more of the following: duration of call, rate period, mileage, or total usage.

Wide Area Telecommunications Service (WATS) - An AT&T service which provides a special line allowing the subscriber to make calls to any location within a specific zone or Service Area on a direct distance dialing basis at a reduced rate.

APPENDIX C

AREA CODE AND PREFIX LISTING FOR MCI NETWORK

<16 November 1983>

Area Code 201

201 221 224 225 226 227 228 231 232 233 235 238 239 241 242
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266 267 268 272 273 276 277 278 279 283 284 285 287 288 289
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365 366 368 371 372 373 374 375 376 377 379 381 382 384 385
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526 527 533 538 539 540 541 543 545 546 547 548 549 558 560
561 564 565 567 568 569 570 572 574 575 581 582 585 589 592
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665 667 668 670 672 673 674 675 676 677 678 684 685 686 687
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Area Code 202 ****Entire Area Code Is Served**

Area Code 203

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Area Code 205

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534 535 536 539 567 569 583 591 592 595 599 626 631 633 640
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Area Code 206

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Area Code 208

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Area Code 209

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Area Code 212 ****Entire Area Code Is Served****

Area Code 213 ****Entire Area Code Is Served****

Area Code 214

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Area Code 215

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Area Code 217

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Area Code 219

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Area Code 301

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Area Code 302

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Area Code 303

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695 696 697 698 699 722 733 737 740 741 744 750 751 752 753
755 756 757 758 759 761 762 770 771 772 773 776 777 778 779
780 781 785 789 790 791 793 794 795 797 798 799 820 821 823
825 826 830 831 832 834 837 839 841 850 851 855 861 863 866
869 890 892 893 894 896 898 922 934 935 936 937 938 947 948
958 966 972 973 976 977 978 979 980 985 986 987 988 989

Area Code 304

232 233 234 242 243 277 336 342 343 344 345 346 347 348 357
394 547 722 727 744 747 755 756 757 766 768 776 840 843 845
899 925 949 965 968 984 988

Area Code 305

221 223 226 232 233 235 237 238 245 246 247 248 251 252 253
255 257 258 261 262 263 264 266 270 271 273 274 275 277 279
281 282 284 285 291 293 295 298 299 324 325 326 327 331 339
343 345 350 351 352 357 358 361 365 371 372 373 374 377 379
382 384 385 386 387 389 398 399 420 421 422 423 424 425 426
427 428 429 431 432 433 434 435 439 441 442 443 444 445 446
447 448 449 454 456 457 458 462 463 467 469 472 473 474 475
476 484 485 486 490 491 492 493 521 522 523 524 525 526 527
528 529 531 532 533 534 537 538 541 543 544 545 547 548 550
551 552 553 554 556 557 558 559 561 563 564 565 566 568 573
576 577 578 579 580 581 582 583 584 585 586 587 588 591 592
593 594 595 596 598 620 621 622 624 625 626 627 628 629 633
634 635 637 638 642 643 644 645 646 647 649 650 651 652 653
655 656 657 659 660 661 662 663 665 666 667 669 671 672 673
674 677 678 681 683 684 685 686 687 688 689 691 693 694 695
696 699 721 722 726 731 732 733 734 735 736 737 739 741 742
744 746 747 748 749 751 754 756 757 758 759 761 762 763 764
765 766 767 769 771 772 774 776 781 782 785 786 788 791 792
793 797 821 822 823 824 825 828 830 831 832 833 834 835 836
837 840 841 842 843 844 845 848 849 850 851 854 855 856 857
858 859 861 862 864 865 866 868 869 871 873 874 876 877 883
884 885 886 887 888 889 891 893 894 895 896 897 898 899 920
921 922 923 925 926 927 928 929 931 932 935 936 937 939 940
941 942 943 944 945 946 947 948 949 952 961 962 963 964 965
966 967 968 969 971 972 973 974 975 979 981 983 985 987 989

Area Code 307

632 634 635 637 638 662 771 772 775 777 778

Area Code 309

637 655 671 672 673 674 675 676 679 682 685 686 688 690 691
692 693 694 697 698 699 745 751 752 755 757 762 764 786 787
788 791 792 793 794 796 797 798 799

Area Code 312 ****Entire Area Code Is Served**

Area Code 313

221 222 223 224 225 226 232 233 234 235 237 238 239 245 247
252 254 255 256 257 259 261 263 264 267 268 270 271 272 273
274 275 276 277 278 280 281 282 283 284 285 286 287 288 291
292 293 294 295 296 297 298 322 323 326 331 332 333 334 335
336 337 338 341 342 343 344 345 348 349 351 352 353 354 355
356 357 358 360 361 362 363 365 366 368 369 371 372 373 374
375 377 381 382 383 386 388 389 391 393 394 397 398 399 420
421 422 423 424 425 427 430 431 434 435 437 441 442 444 445
446 451 453 455 456 459 463 464 465 466 467 468 469 471 472
473 474 476 477 478 479 481 482 483 484 485 486 487 491 492
493 494 495 496 497 499 521 522 523 524 525 526 527 528 531
532 533 534 535 536 537 538 539 540 541 542 543 544 545 546
547 548 549 551 552 553 554 556 557 559 561 562 563 564 565
566 567 568 569 571 572 573 574 575 576 577 579 581 582 583
584 585 588 589 591 592 593 594 595 621 623 624 625 626 627
628 629 631 635 636 637 640 641 642 643 644 645 646 647 649
651 652 653 655 656 658 659 661 662 663 665 666 668 669 671
673 674 675 676 681 682 683 684 685 686 687 689 693 694 695
697 698 699 721 722 723 728 729 731 732 733 735 736 738 739
742 743 744 750 751 754 755 756 757 758 759 761 762 763 764

766 767 768 769 771 772 773 774 775 776 777 778 779 785 787
789 791 792 821 822 823 824 826 827 828 831 832 833 834 835
836 837 838 839 841 842 843 846 847 848 849 851 852 853 855
856 857 858 861 862 863 864 865 866 867 868 869 871 872 873
874 875 876 879 881 882 883 884 885 886 887 888 891 892 893
894 895 896 897 898 899 921 922 923 924 925 926 927 928 931
932 933 934 935 937 939 941 942 943 946 949 956 961 962 963
964 965 966 967 968 971 972 973 977 978 979 981 994 995 996

Area Code 314

225 227 231 232 233 234 241 247 253 261 263 273 275 278 287
289 291 296 298 321 326 342 343 344 351 352 353 355 361 362
367 371 375 376 381 382 383 385 388 389 391 394 421 423 425
426 427 428 429 432 434 436 441 447 454 458 464 465 467 469
481 487 521 522 524 525 527 531 532 533 534 535 536 544 553
554 561 567 569 572 576 577 595 621 622 623 631 638 644 645
647 652 658 664 677 679 694 721 723 724 725 726 727 731 739
741 752 753 761 768 771 772 773 776 777 781 821 822 823 825
826 831 832 837 838 839 842 843 846 849 851 854 855 862 863
865 867 868 869 872 878 889 892 894 895 899 921 922 925 928
936 938 942 946 947 948 957 961 962 964 965 966 968 969 975
982 991 993 994 997

Area Code 315

421 422 423 424 425 426 428 432 433 437 445 446 451 452 454
455 456 457 458 463 468 469 470 471 472 473 474 475 476 477
478 479 487 488 492 622 623 625 633 635 636 637 638 640 652
655 656 662 668 672 673 675 676 677 678 682 683 685 687 689
695 696 697 699 890 963

Area Code 316

261 262 263 264 265 266 267 268 269 436 522 524 526 529 574
681 682 683 684 685 686 687 688 689 721 722 733 744 755 772
773 775 776 777 778 788 794 796 799 832 838 942 943 945 946

Area Code 317

222 228 232 233 235 236 237 239 240 241 242 243 244 247 248
251 252 253 255 257 259 261 262 263 264 265 266 267 269 271
272 273 282 283 284 285 286 288 289 291 293 297 298 299 326
335 352 353 354 356 357 358 359 372 378 396 422 462 467 468
485 533 534 535 536 539 542 543 545 546 547 549 552 556 560
562 630 631 632 633 634 635 636 637 638 639 642 643 644 646
649 724 734 736 738 741 745 747 754 755 759 768 769 773 774
776 778 779 782 783 784 786 787 788 789 823 831 835 838 839
842 844 845 846 848 849 852 856 861 862 871 872 873 875 877
878 881 882 887 888 892 894 896 897 898 899 923 924 925 926
927 928 929 994 996

Area Code 318

221 222 226 227 231 232 233 234 235 237 261 264 269 294 424
425 456 459 631 632 635 636 670 671 674 683 686 687 688 742
746 747 797 798 837 856 861 865 868 869 873 896 925 929 933
938 949 965 981 984 987 988 989

Area Code 319

225 232 233 234 235 236 266 268 273 277 282 284 285 289 291
296 322 323 324 326 332 337 338 344 351 353 354 355 356 359
362 363 364 365 366 369 373 377 381 383 386 388 390 391 393
395 396 398 399 626 644 645 679 683 842 846 848 849 851 854
857 895 958 959 983 984 987 988 989

Area Code 401

224 231 232 245 246 247 252 253 255 272 273 274 275 276 277
278 331 333 334 336 351 353 379 397 399 421 431 433 434 437
438 456 457 461 463 464 467 521 525 528 572 574 621 647 722
723 724 725 726 727 728 732 737 738 739 751 761 776 781 785
821 822 823 825 826 827 828 831 861 863 865 884 885 886 934
941 942 943 944 949 955

Area Code 402

221 238 253 271 280 281 289 291 292 293 294 330 331 332 333
334 339 341 342 344 345 346 348 359 390 391 392 393 397 398
399 421 422 423 435 444 449 451 453 455 457 464 466 467 470
471 472 473 474 475 476 477 483 488 489 493 496 498 536 541
551 553 554 556 558 559 571 572 592 593 633 691 731 733 734
742 779 780 781 782 783 784 785 786 787 788 789 790 791 792
794 795 796 797 798 894 895 896 962 977 978

Area Code 404

221 223 225 231 233 237 238 239 241 243 244 247 252 255 256
257 261 262 266 284 286 288 289 292 294 296 299 320 321 325
329 344 346 349 351 352 355 361 362 363 366 371 372 373 377
378 391 392 393 394 396 399 420 422 424 425 426 427 428 429
432 433 434 435 436 441 442 445 446 447 448 449 451 452 454
455 457 458 461 463 466 469 471 474 475 476 477 478 482 483
487 489 491 493 496 498 521 522 523 524 525 526 527 529 530
533 541 556 564 565 572 577 581 586 587 588 592 622 624 627
631 633 634 636 653 656 658 659 681 688 691 696 699 722 724
733 736 737 738 739 752 753 755 758 761 762 763 765 766 767
768 790 791 792 793 794 796 798 799 823 828 843 860 863 868
871 872 873 874 875 876 881 885 890 892 894 897 898 899 921
922 923 925 926 928 929 934 936 938 939 941 942 943 944 945
946 948 949 951 952 953 955 957 961 962 963 964 968 969 971
972 973 974 975 977 979 981 982 987 991 992 993 996 997 998
999

Area Code 405

231 232 235 236 239 270 271 272 278 292 321 324 325 329 340
341 348 350 354 360 364 366 373 376 381 387 390 391 392 396
399 424 427 460 478 491 495 521 523 524 525 528 556 599 630
631 632 634 636 670 672 677 681 682 685 686 691 721 722 728
732 733 734 736 737 745 751 752 755 769 771 781 787 789 793
794 799 840 841 842 843 848 942 943 946 947 948 949 990 996

Area Code 408

224 225 226 227 238 241 243 244 245 246 247 248 249 251 252
253 255 256 257 258 259 262 263 264 265 266 267 268 269 270
272 274 275 277 279 280 281 284 286 287 288 289 292 293 294
295 296 297 298 299 335 336 338 353 354 356 358 365 370 371
374 377 378 379 395 399 422 423 424 425 426 427 429 438 443
446 448 449 455 462 463 475 476 484 491 496 554 559 575 578
629 633 662 663 675 688 720 721 723 725 727 729 730 732 733
734 735 736 737 738 739 741 742 743 744 745 746 747 748 749
754 756 757 758 773 865 866 867 920 923 925 926 942 943 945
946 947 970 971 972 973 977 978 980 984 985 986 987 988 993
994 995 996 997 998

Area Code 409

260 272 361 589 684 693 696 722 724 727 735 736 737 740 744
752 753 755 761 762 763 764 765 766 768 769 775 779 786 794
796 822 823 832 833 835 838 839 842 845 846 860 866 892 898
899 925 935 938 942 945 948 962 963 982 983 985 986 989

Area Code 412

221 222 223 225 227 228 231 232 234 237 241 242 243 244 245
246 247 255 256 257 261 262 263 264 266 269 271 273 276 277
279 281 282 283 284 285 287 288 321 322 323 325 327 328 329
331 333 335 337 339 341 343 344 345 351 355 356 359 361 362
363 364 366 367 371 372 373 374 375 378 381 391 392 393 394
396 421 422 423 429 430 431 433 434 437 438 439 441 442 445
446 456 461 462 464 466 468 469 471 481 482 484 486 487 488
495 521 523 527 531 533 537 539 553 561 562 563 564 565 566
569 571 573 578 583 586 587 596 621 622 624 626 628 633 636
637 642 643 644 647 653 655 661 663 664 665 668 672 673 675
677 678 681 682 683 687 725 728 731 734 737 741 745 746 751
754 761 765 766 767 771 773 774 775 777 778 781 782 784 785
787 788 789 793 795 821 822 823 824 828 829 830 831 832 833
834 835 836 837 838 840 843 846 847 854 855 856 857 859 863
864 865 869 872 873 881 882 884 885 892 921 922 923 925 928
931 936 937 941 948 961 963 967

Area Code 413

442 443 445 447 448 494 499 525 532 533 534 536 538 539 543
547 557 562 566 567 568 569 575 583 589 592 593 594 596 598
623 637 655 684 698 730 732 733 734 736 737 739 781 782 783
785 786 787 788 789 955

Area Code 414

224 225 226 228 241 242 243 246 251 252 255 257 258 259 263
264 265 269 271 272 273 274 276 277 278 281 282 289 291 321
327 332 334 338 342 344 347 351 352 353 354 355 357 358 367
372 374 375 377 383 384 399 421 422 423 425 438 442 444 445
447 449 452 453 456 457 458 459 461 462 463 464 466 467 475
476 477 481 482 483 527 529 533 535 541 542 543 544 545 546
547 548 549 551 552 553 554 562 564 565 583 626 629 631 632
633 634 636 637 639 643 644 645 647 649 652 654 656 657 658
662 668 671 672 675 677 678 679 681 688 691 692 693 694 697
744 747 753 761 762 764 765 768 769 771 774 778 781 782 783
784 785 786 795 797 798 799 835 843 844 857 859 871 872 873
878 886 921 922 923 929 931 933 935 936 937 961 962 963 964
999

Area Code 415 ****Entire Area Code Is Served****

Area Code 417

623 624 625 649 673 725 732 736 742 743 744 753 759 765 781
782 831 833 836 862 864 865 866 869 881 882 883 885 887

Area Code 419

240 241 242 243 244 245 246 247 248 249 255 259 359 381 382
385 389 433 470 471 472 473 474 475 476 478 531 534 535 536
537 625 626 627 661 666 684 691 693 698 726 727 729 825 826
829 836 837 838 841 855 865 866 867 872 874 875 877 878 882
885 891 893 936

Area Code 501

223 224 225 227 370 371 372 373 374 375 376 378 433 455 490
562 565 568 569 660 661 663 664 666 753 758 771 821 834 835
847 851 868 888 897 945 961 982 985 988

Area Code 502

222 228 229 231 239 241 244 245 267 361 363 366 367 368 423
425 426 429 447 448 449 451 452 454 456 458 459 491 499 540
560 561 562 566 568 569 571 580 581 582 583 584 585 587 588

589 634 635 636 637 772 774 775 776 778 893 895 896 897 922
933 935 937 955 957 964 966 968 969

Area Code 503

220 221 222 223 224 225 226 227 228 229 230 231 232 233 234
235 236 237 238 239 240 241 242 243 244 245 246 248 249 251
252 253 254 255 256 257 280 281 282 283 284 285 286 287 288
289 292 293 294 295 297 341 342 343 344 345 362 363 364 370
371 373 378 390 393 399 461 465 484 485 581 585 588 620 621
625 626 627 628 629 630 631 632 635 636 637 638 639 640 641
642 643 644 645 646 647 648 649 652 653 654 655 656 657 658
659 661 663 665 666 667 668 681 682 683 684 685 686 687 688
689 721 726 741 743 746 747 749 760 761 771 774 775 777 790
796 844 890 896 933 935 937 995 998

Area Code 504

241 242 244 245 246 254 255 260 261 262 271 272 273 275 277
278 279 282 283 286 288 291 292 293 334 340 341 342 343 344
346 347 348 349 355 356 357 358 359 361 362 363 364 366 367
368 377 379 381 382 383 387 388 389 391 392 393 394 399 431
436 441 443 454 455 456 464 466 467 468 469 482 483 484 486
488 521 522 523 524 525 527 528 529 561 563 566 568 569 575
581 586 587 588 589 594 595 596 627 642 654 656 662 664 665
670 676 682 684 686 689 721 722 729 733 734 737 738 749 766
767 769 771 774 775 778 821 822 826 827 831 832 833 834 835
837 838 851 861 865 866 868 872 873 876 879 885 887 888 889
891 895 897 899 922 923 924 925 926 927 928 942 943 944 945
947 948 949 950

Area Code 505

242 243 247 255 256 262 264 265 266 268 277 281 292 293 294
296 298 299 344 345 765 766 821 822 831 836 841 842 843 844
845 846 848 865 867 869 873 877 881 883 884 888 892 897 898

Area Code 507

281 282 284 285 286 287 288 289 356 365 367 533 545 753 775
867 876 932

Area Code 512

220 221 222 223 224 225 226 227 228 229 230 231 233 241 242
243 244 246 247 250 251 255 258 259 261 262 263 264 265 266
267 270 271 272 276 282 288 289 299 327 328 329 333 337 340
341 342 343 344 345 346 349 350 366 381 383 385 387 397 399
421 423 425 428 432 433 434 435 436 441 442 443 444 445 447
448 451 452 453 454 458 459 464 465 467 469 470 471 472 473
474 475 476 477 478 479 480 482 492 493 494 495 496 497 531
532 533 534 536 541 542 544 546 548 560 572 573 575 576 578
581 585 621 622 623 624 625 626 627 628 629 630 631 633 635
636 643 647 648 649 650 651 652 653 654 655 656 657 658 659
661 662 667 670 671 673 674 675 677 679 680 681 682 684 686
687 688 690 691 692 694 695 696 698 699 732 733 734 735 736
737 748 781 787 797 821 822 824 826 828 831 834 835 836 837
838 843 845 851 852 853 854 855 857 870 881 882 883 884 886
887 888 892 921 922 923 924 925 926 927 928 929 933 937 939
943 975 991 992 993

Area Code 513

220 221 222 223 224 225 226 227 228 229 231 232 233 234 236
237 241 242 243 244 245 247 248 251 252 253 254 255 256 257
258 259 262 263 265 267 268 271 272 274 275 276 277 278 281
290 293 294 296 297 298 299 321 322 323 324 325 327 328 331
346 347 351 352 353 367 369 381 385 388 389 390 396 397 399

420 421 422 423 424 425 426 429 433 434 435 439 443 445 449
451 454 457 461 462 467 471 474 475 476 481 482 489 499 521
522 527 528 530 531 533 536 539 541 542 551 553 554 557 559
561 562 563 565 566 568 569 574 575 576 579 583 589 591 595
598 621 624 625 629 631 632 641 647 651 659 661 662 665 671
677 681 683 684 721 722 724 729 731 732 733 734 737 738 741
742 743 745 746 748 749 751 752 753 755 756 761 762 763 765
769 771 772 777 779 782 786 787 791 793 794 797 820 821 822
825 828 829 831 832 835 836 837 841 845 848 849 851 852 853
854 859 861 862 863 864 865 866 867 868 870 871 872 873 874
878 879 882 885 890 891 896 898 921 922 923 931 941 943 948
950 961 964 969 972 977 979 984 988

Area Code 515
223 224 225 232 233 239 242 243 244 245 246 247 255 262 263
265 266 270 271 274 276 277 278 279 280 281 282 283 284 285
286 287 288 289 292 294 296 834 958 959 961 964 965 966 967
981 984 986 987 989 992 993 996 999

Area Code 516 ****Entire Area Code Is Served****

Area Code 517
321 322 323 332 337 339 349 351 353 355 363 371 372 373 374
377 393 394 482 483 484 485 487 489 496 624 625 626 627 631
636 641 642 643 645 646 651 652 655 662 663 667 675 676 684
686 687 689 694 695 699 752 753 754 755 770 771 776 777 781
790 791 792 793 799 832 835 839 865 868 882 887 892 893 894
895

Area Code 518
235 237 266 270 271 272 273 274 279 283 286 346 355 356 370
371 372 374 377 381 382 383 384 385 386 393 399 434 436 438
439 445 447 449 453 454 455 456 457 458 459 462 463 465 470
471 472 473 474 475 476 477 482 489 584 587 663 664 674 732
753 756 765 766 767 768 783 785 797 861 864 869 872 877 882
885 895 899

Area Code 601
352 353 354 355 359 362 366 371 372 373 376 825 829 845 852
856 857 866 878 879 922 924 932 936 939 944 948 949 956 957
960 961 968 969 981 982 987 992

Area Code 602
224 231 233 234 235 236 237 238 239 241 242 243 244 245 246
247 248 249 251 252 253 254 255 256 257 258 259 260 261 262
263 264 265 266 267 268 269 270 271 272 273 274 275 276 277
278 279 285 293 294 295 296 297 298 299 323 325 326 327 435
437 438 551 573 574 575 576 577 578 581 582 583 584 585 588
589 621 622 623 624 626 628 629 721 741 742 743 744 745 746
747 748 749 790 791 792 795 820 829 830 831 832 833 834 835
837 838 839 840 841 842 843 846 848 849 853 856 860 861 862
863 864 866 867 869 872 873 876 877 878 879 880 881 882 883
884 885 886 887 888 889 890 891 892 893 894 895 897 898 899
921 924 931 932 933 934 935 936 937 938 939 941 942 943 944
945 946 947 948 949 951 952 953 954 955 956 957 959 961 962
963 964 965 966 967 968 969 971 972 973 974 975 977 978 979
981 982 983 984 985 986 987 988 990 991 992 993 994 995 996
997 998

Area Code 606

223 231 232 233 252 253 254 255 257 258 259 261 266 268 269
272 273 276 277 278 283 291 292 293 299 331 341 342 344 356
359 371 384 397 431 441 485 491 493 525 565 566 572 581 586
628 635 689 727 781 846 858 873 885 887 936 939

Area Code 608

221 222 231 233 238 241 244 246 249 251 252 255 256 257 258
262 263 264 266 267 271 273 274 275 291 362 364 365 424 437
455 592 635 655 676 752 754 755 756 764 767 798 829 831 832
833 835 836 837 838 839 845 846 849 868 873 876 879 883 884
936 993

Area Code 609

227 228 234 235 292 295 298 338 342 346 354 365 392 393 394
396 424 428 429 435 445 456 482 488 541 546 547 561 567 573
581 582 585 586 587 589 590 596 599 627 629 633 662 663 665
667 694 695 728 736 742 755 757 767 768 771 772 778 779 783
784 786 795 829 854 858 863 866 881 882 883 888 890 896 931
933 936 939 962 963 964 966 983 984 989

Area Code 612

221 222 223 224 225 226 227 228 251 252 253 255 259 291 292
293 296 297 298 330 331 332 333 334 335 336 338 339 340 341
342 343 344 347 348 349 355 356 363 370 371 372 373 374 375
376 377 378 379 387 393 420 421 422 423 424 425 426 427 428
429 430 431 432 433 434 435 436 437 438 439 441 443 445 446
447 448 450 451 452 454 455 456 457 458 459 460 461 462 463
464 469 471 472 473 474 475 476 477 478 479 481 482 483 484
487 488 489 492 497 498 499 520 521 522 529 533 534 535 536
537 538 540 541 542 544 545 546 553 558 559 560 561 566 571
572 574 588 620 622 623 631 633 636 638 641 642 644 645 646
647 681 685 690 696 698 699 721 722 724 725 726 727 729 731
733 735 736 738 739 743 746 753 755 757 770 771 772 774 776
777 778 779 780 781 784 786 788 789 822 823 824 825 827 828
830 831 835 853 854 858 861 866 869 870 871 872 874 881 884
885 887 888 890 893 894 920 921 922 924 925 926 927 929 931
932 933 934 935 936 937 938 941 944 968 977 989

Area Code 614

221 222 223 224 225 227 228 229 231 235 236 237 238 239 251
252 253 258 261 262 263 265 267 268 272 274 275 276 278 279
281 291 294 297 299 362 363 369 382 383 387 389 421 422 424
431 436 438 443 444 445 451 457 459 460 461 462 463 464 465
466 467 468 469 471 475 476 481 486 488 491 492 494 497 499
524 528 536 548 569 595 653 654 666 687 726 746 747 756 764
766 771 821 833 836 837 846 855 860 861 862 863 864 866 868
870 871 875 876 877 878 879 881 882 885 888 889 890 891 895
927 965 969 997

Area Code 615

226 227 228 236 238 242 244 248 251 252 254 255 256 259 262
265 266 267 269 292 297 298 320 321 322 323 326 327 329 331
332 333 344 352 353 356 358 360 361 362 366 367 373 377 383
385 386 387 396 431 435 439 457 466 482 483 494 521 522 523
524 525 538 544 546 552 558 573 574 576 577 579 584 588 622
624 629 632 637 642 645 646 647 648 656 669 673 687 688 689
690 691 693 694 697 698 737 741 742 747 748 749 751 752 754
755 756 757 758 764 766 776 778 780 782 790 791 793 794 798
799 821 822 824 825 832 833 834 838 842 843 847 855 859 860
865 867 868 870 875 876 877 878 883 885 886 889 892 894 899
922 933 938 945 947 966 968 970 971 974 992

Area Code 616

241 242 243 245 246 247 281 323 327 329 342 343 344 345 349
361 363 364 372 375 381 382 383 384 385 388 451 452 453 454
455 456 457 458 459 530 531 532 534 538 623 624 626 628 629
649 657 664 665 668 669 671 676 677 679 681 682 685 691 692
694 698 731 770 774 784 791 866 868 874 877 878 887 891 896
897 942 949 957

Area Code 617

223 225 227 229 231 232 233 235 236 237 241 242 243 244 245
246 247 250 251 253 254 256 258 259 261 262 265 266 267 268
269 272 273 274 275 276 277 282 284 286 287 288 289 292 296
298 321 322 323 324 325 326 327 328 329 331 332 333 335 337
338 353 354 357 358 359 361 364 365 366 367 368 376 381 383
387 389 391 392 393 395 396 421 422 423 424 426 427 429 431
434 436 437 438 439 442 444 445 449 451 452 453 454 455 458
459 461 463 466 469 471 472 479 482 483 484 488 489 491 492
494 495 497 498 522 523 524 527 536 542 547 552 561 566 567
569 574 576 577 578 579 581 589 592 593 594 595 596 598 599
620 623 625 628 633 635 637 638 641 642 643 646 647 648 649
651 653 654 655 657 658 661 662 663 665 666 667 671 684 692
696 698 720 721 722 723 725 726 727 729 731 732 734 735 738
739 740 742 743 749 752 753 754 755 756 757 762 767 769 770
773 776 781 782 783 785 786 787 788 791 792 793 798 799 821
825 828 829 832 835 839 842 843 845 846 848 849 851 852 853
855 856 860 861 862 863 864 865 868 869 870 872 875 876 877
879 881 882 884 885 886 889 890 891 892 893 894 895 899 923
924 925 926 929 931 933 935 936 937 938 942 944 955 956 957
961 963 964 965 967 969 973 986 987

Area Code 618

234 235 256 271 274 277 332 337 344 345 397 398 399 451 452
482 624 632 744 746 797 874 875

Area Code 619

221 222 223 224 225 226 229 230 231 232 233 234 235 236 237
238 239 260 262 263 264 265 266 267 268 270 271 272 273 274
275 276 277 278 279 280 281 282 283 284 286 287 289 290 291
292 293 294 295 296 297 298 299 320 321 323 324 325 327 328
340 341 342 343 345 346 347 393 396 397 398 399 420 421 422
423 424 425 426 427 428 429 430 433 434 435 436 437 438 439
440 442 443 444 445 447 448 449 450 451 452 453 454 455 456
457 458 459 460 461 462 463 464 465 466 469 470 471 474 475
477 479 480 481 483 484 485 486 487 488 489 560 561 562 563
564 565 566 568 569 570 571 573 574 575 576 578 579 580 582
583 584 586 588 589 690 691 692 693 695 697 698 699 721 722
723 724 725 726 727 728 729 741 742 743 744 745 746 747 748
749 753 755 756 757 758 789 940 941 942

Area Code 702

246 293 294 295 322 323 329 331 342 343 345 348 356 358 359
361 362 363 367 368 369 381 382 383 384 385 386 389 399 451
452 453 454 456 457 458 459 564 565 566 634 642 643 644 645
646 647 648 649 673 677 731 732 733 734 735 736 737 739 747
784 785 786 788 789 793 796 798 825 826 827 831 832 844 847
849 851 852 853 870 871 873 876 877 878 882 883 885 887 926
928 972

Area Code 703

221 222 235 237 241 243 247 250 255 256 273 274 276 278 280
281 284 285 321 323 325 327 329 332 335 338 339 342 343 344
345 351 352 354 356 360 361 362 366 367 368 369 370 371 373
375 378 379 380 384 385 387 389 425 430 435 437 442 448 450

451 455 471 476 486 487 490 491 494 521 522 524 525 527 528
532 533 534 536 538 548 549 550 553 556 557 558 560 561 563
569 573 578 582 590 591 594 620 631 640 642 643 644 659 660
661 664 668 670 671 680 683 684 685 687 690 691 698 734 750
751 752 754 756 759 765 768 774 777 780 781 786 790 791 820
821 822 823 827 830 836 838 841 845 849 860 876 882 883 890
892 893 898 899 920 922 929 931 938 941 947 954 960 968 971
972 974 977 978 979 981 982 985 986 989 992 998

Area Code 704

331 332 333 334 335 364 365 366 371 372 373 374 375 376 377
378 379 392 393 394 398 399 455 523 525 527 535 536 537 541
542 545 552 553 554 563 567 568 588 594 596 597 598 821 825
827 840 843 847 875 882 889 892

Area Code 707

433 523 525 526 527 528 538 539 542 544 545 546 552 553 554
557 575 576 578 584 585 642 643 644 646 648 664 745 746 795
823 829 833 838 887

Area Code 712

232 233 239 252 255 258 274 276 277 279 322 323 325 328 347
366 428 943 946

Area Code 713

220 221 222 223 224 225 226 227 228 229 230 232 235 236 237
241 251 255 256 259 266 270 271 277 280 284 285 288 292 320
324 328 331 332 333 334 337 338 339 341 342 343 346 350 351
353 354 356 358 359 363 367 370 371 373 376 383 388 390 391
392 393 420 422 424 425 426 427 428 431 432 433 434 436 437
438 439 440 441 442 443 444 445 446 447 448 449 450 451 452
453 454 455 456 457 458 459 460 461 462 463 464 465 466 467
468 469 470 471 472 473 474 475 476 477 479 480 481 482 483
484 485 486 487 488 489 490 491 492 493 494 495 496 497 498
499 520 521 522 523 524 525 526 527 528 529 530 531 533 534
537 538 540 541 545 546 550 551 552 554 556 558 559 571 573
574 577 578 580 581 583 585 590 591 599 620 621 622 623 626
627 629 630 631 633 635 640 641 643 644 645 649 650 651 652
654 656 658 659 660 661 662 663 664 665 666 667 668 669 670
671 672 673 674 675 676 678 679 680 681 682 683 686 688 690
691 692 694 695 697 699 720 721 723 726 728 729 731 733 734
738 739 741 747 748 749 750 751 754 757 759 771 772 774 776
777 778 780 781 782 783 784 785 788 789 790 791 792 795 797
799 820 821 827 840 841 844 847 850 852 859 861 862 864 868
869 870 871 877 879 880 881 888 890 893 895 896 920 921 923
924 926 928 929 930 931 932 933 937 939 940 941 943 944 946
947 951 952 953 954 955 956 957 960 961 965 966 972 973 974
975 977 978 980 981 984 987 988 991 993 995 996 997 998 999

Area Code 714

220 240 241 250 261 321 350 351 354 359 369 370 380 381 382
383 384 385 391 431 432 441 467 472 474 476 491 492 493 494
495 496 497 498 499 502 517 520 521 522 523 524 525 526 527
528 529 530 531 532 533 534 535 536 537 538 539 540 541 542
543 544 545 546 547 548 549 550 551 552 553 554 556 557 558
559 567 581 586 591 592 593 594 595 596 597 598 599 620 621
622 623 624 625 626 627 628 629 630 631 632 633 634 635 636
637 638 639 640 641 642 643 644 645 646 649 650 651 660 661
662 667 669 670 671 673 675 680 681 682 683 684 685 686 687
688 689 720 730 731 732 738 739 740 742 750 751 752 754 756
759 760 761 768 770 771 772 773 774 775 776 777 778 779 780
781 783 784 785 786 787 788 790 792 793 794 795 796 797 798
820 821 822 823 824 825 826 827 828 829 830 831 832 833 834

835 836 837 838 839 840 841 842 846 847 848 850 851 852 855
856 857 859 861 863 865 870 871 874 875 877 879 880 881 882
883 884 885 886 887 888 889 891 892 893 894 895 896 897 898
921 937 945 946 947 951 952 953 954 955 956 957 960 961 962
963 964 966 968 969 970 971 972 973 974 975 977 978 979 980
981 982 983 984 985 986 987 988 989 990 991 992 993 994 995
996 997 998 999

Area Code 716

221 222 223 225 227 232 235 236 238 244 247 248 254 258 262
263 265 266 271 275 278 282 283 284 285 286 288 293 297 323
325 328 334 337 338 342 352 359 377 381 385 392 395 398 422
423 424 425 426 427 428 433 434 436 439 442 454 457 458 461
464 467 473 475 477 482 494 496 533 537 538 542 544 546 549
582 586 588 592 594 621 624 625 626 627 631 632 633 634 636
637 643 644 647 648 649 652 654 655 662 663 668 671 674 675
681 683 684 685 686 687 688 689 690 691 692 693 694 695 696
722 724 726 731 741 745 751 754 759 772 773 791 821 822 823
824 825 826 827 828 831 832 833 834 835 836 837 838 839 842
843 844 845 846 847 849 852 853 854 855 856 862 865 872 873
874 875 876 877 878 879 881 882 883 884 885 886 887 889 890
891 892 893 894 895 896 897 898 921 924 937 941 947 955 964
974 987 992

Area Code 717

225 232 233 234 236 238 243 244 245 246 249 252 255 258 266
283 284 285 287 288 291 292 295 299 342 343 344 346 347 348
354 378 383 392 393 394 397 428 457 464 469 472 486 489 533
534 545 558 560 561 562 563 564 566 569 586 587 599 626 627
652 653 654 655 656 657 664 665 687 689 691 693 697 698 732
737 741 755 757 761 763 764 766 767 768 771 774 776 780 782
783 786 787 790 792 822 823 824 825 826 829 842 843 845 846
848 854 872 876 896 898 921 938 939 944 948 957 961 963 969
986

Area Code 801

224 225 226 227 237 250 254 255 261 262 263 264 265 266 268
272 277 278 292 295 298 321 322 328 350 355 359 363 364 373
374 375 377 378 379 392 393 394 399 423 451 465 466 467 479
482 483 484 485 486 487 489 521 522 524 526 530 531 532 533
534 535 537 539 544 546 561 566 571 572 581 582 583 584 585
621 625 626 627 731 745 754 756 768 773 774 776 777 782 785
798 825 942 943 964 965 966 967 968 969 972 973 974

Area Code 803

232 233 235 239 242 243 244 246 252 254 256 268 269 271 277
281 282 288 292 294 295 297 298 299 345 353 356 359 433 439
461 463 472 474 476 573 574 576 578 579 582 583 585 592 596
731 732 733 735 736 738 748 751 754 755 758 765 771 772 776
777 779 781 782 783 786 787 788 791 794 796 798 799 834 836
845 855 859 862 877 879 895 963 967

Area Code 804

222 225 226 230 231 232 233 244 245 247 254 257 261 262 264
265 266 268 270 271 272 274 275 276 281 282 284 285 288 289
320 321 323 328 329 340 343 345 346 353 355 358 359 363 379
380 393 396 397 398 399 420 421 422 423 424 425 426 427 428
433 440 441 444 445 446 452 455 458 460 461 463 464 465 466
467 468 469 480 481 482 483 484 485 486 487 488 489 490 491
494 495 496 497 499 520 526 533 541 543 545 547 583 587 588
590 592 595 596 599 622 623 625 627 628 629 643 644 648 649
666 667 686 721 722 723 727 728 730 732 733 734 737 739 740
741 743 744 745 746 747 748 749 752 764 771 772 775 780 781

782 784 786 788 790 794 795 796 798 825 826 827 838 840 850
851 853 855 857 858 861 862 865 867 868 872 874 877 878 887
888 898 954

Area Code 805
482 483 484 485 486 487 488 525 565 569 642 643 644 646 647
648 649 652 653 654 656 658 659 682 683 684 685 687 933 961
962 963 964 966 967 968 969 982 983 984 985 986 987

Area Code 806
320 335 352 353 355 358 359 372 373 374 376 378 381 383 622
655 656 741 742 743 744 745 746 747 762 763 765 792 793 794
795 796 797 799 828 829 832 842 863 866 873 885 892

Area Code 808
263 288 373 377 395 396 422 423 449 471 472 474 477 521 523
524 525 526 527 528 531 533 536 537 538 543 544 546 547 548
595 624 653 672 732 734 735 737 833 834 836 839 841 842 845
847 848 922 923 926 941 942 943 944 945 946 947 948 949 955
988

Area Code 812
246 256 282 283 284 286 288 332 333 334 335 336 337 339 342
372 376 378 379 526 546 579 587 824 825 837 872 876 892 923
944 945 948 988

Area Code 813
221 223 224 225 226 227 228 229 231 232 234 236 237 238 239
240 241 242 247 248 251 253 254 256 257 258 259 272 273 280
321 323 327 340 343 344 345 347 360 363 367 381 384 391 392
393 397 398 441 442 443 446 447 448 461 462 521 522 525 526
527 530 531 535 536 541 544 545 546 576 577 581 584 585 586
593 595 596 621 622 623 626 634 645 677 681 684 685 689 725
726 733 734 736 738 784 785 786 796 797 799 821 822 823 824
825 830 831 832 833 834 835 837 839 840 855 864 866 867 870
871 872 875 876 877 879 883 884 885 886 887 893 894 895 896
898 920 932 933 934 935 937 938 949 961 962 963 969 971 972
973 974 977 985 986 988 989 990 996 999

Area Code 814
255 266 269 288 322 446 451 452 453 454 455 456 459 467 474
476 479 487 495 533 535 536 538 539 684 695 696 725 732 734
739 742 774 796 825 833 838 864 866 868 871 875 886 898 899
942 943 944 946 949

Area Code 815
226 229 234 282 332 335 337 338 344 385 389 397 398 399 423
424 436 439 455 459 465 467 468 469 475 476 478 485 544 547
623 624 629 633 645 654 722 723 725 726 727 729 740 741 744
765 773 774 834 838 874 877 885 886 923 962 963 964 965 966
968 987

Area Code 816
221 224 228 229 231 232 233 234 238 241 242 243 245 251 252
253 254 257 271 274 275 276 279 283 322 331 333 346 348 353
356 358 361 363 364 373 374 391 421 436 443 444 452 453 454
455 459 461 464 468 471 474 478 483 523 524 525 531 532 537
556 561 572 576 578 587 623 667 685 688 734 737 741 753 756
757 761 763 765 774 781 792 795 796 833 836 842 844 861 873
881 891 921 923 924 926 931 932 941 942 966 968 995 997

Area Code 817

232 236 237 244 246 249 261 265 267 268 273 274 275 277 280
281 282 283 284 292 293 294 295 297 322 332 334 335 336 338
346 355 356 379 382 383 387 390 429 430 431 439 441 443 444
447 448 451 452 457 460 461 465 467 469 473 477 478 481 483
485 488 489 491 493 496 498 525 528 529 531 534 535 536 538
540 541 544 551 560 565 566 569 571 572 574 577 586 588 589
592 595 624 625 626 633 640 649 654 656 662 666 679 691 692
696 723 731 732 735 737 738 752 753 754 755 756 757 761 763
766 767 772 776 787 788 792 794 795 799 822 826 829 831 834
836 838 840 844 848 851 853 855 857 859 860 863 870 875 876
877 881 921 923 924 926 927 930

Area Code 818 ****Entire Area Code Is Served****

Area Code 901

272 274 275 276 278 320 321 323 324 327 332 342 345 346 348
353 357 358 362 363 365 369 372 377 382 386 388 392 393 396
397 398 422 423 424 427 452 454 458 521 522 523 524 525 526
527 528 529 535 577 664 668 682 683 685 721 722 725 726 728
729 732 735 743 744 745 754 755 756 761 762 765 766 767 774
775 781 785 789 794 795 797 829 853 867 872 876 922 935 942
946 947 948 988

Area Code 904

241 246 249 251 262 264 266 268 269 272 282 285 289 350 353
354 355 356 358 359 384 387 388 389 393 396 398 399 432 433
434 436 438 452 453 455 456 474 476 477 478 492 631 632 633
634 636 641 642 646 721 723 724 725 731 733 737 739 743 744
751 757 764 765 768 771 772 777 778 781 783 786 791 798 932
944 968 994

Area Code 912

232 233 234 236 238 352 354 355 356 474 477 598 741 742 743
744 745 746 748 781 784 786 788 897 922 923 925 926 927 929
944 964 966

Area Code 913

232 233 234 235 236 262 266 267 268 272 273 281 286 287 288
289 295 296 299 321 334 341 342 354 357 362 371 375 379 381
383 384 422 432 441 478 492 532 537 539 541 542 564 573 574
576 582 588 596 621 631 642 648 649 661 663 671 676 677 681
685 721 722 724 748 749 761 764 775 776 782 788 791 829 831
841 842 843 862 864 887 888 894 897 936 967

Area Code 914

225 232 233 234 235 237 238 241 245 248 251 253 265 268 271
273 276 277 278 279 285 320 321 328 332 335 337 345 346 347
351 352 353 354 356 357 358 359 365 368 375 381 390 391 423
424 425 428 429 472 476 477 478 526 528 533 576 577 578 591
592 623 624 627 631 632 633 634 636 638 642 664 666 667 668
669 681 682 683 684 686 693 694 696 697 698 699 723 725 735
736 737 738 739 747 749 753 761 762 763 764 765 769 776 779
786 789 793 833 834 835 878 890 899 934 936 937 939 941 942
945 946 947 948 949 961 962 963 964 965 967 968 969 997 999

Area Code 915

332 333 334 335 337 362 363 366 367 368 381 385 465 468 469
529 532 533 537 541 542 543 544 545 546 548 561 562 563 564
565 566 568 569 581 584 591 592 593 594 598 653 655 657 658
672 673 675 676 677 678 679 682 683 684 685 686 687 688 689

691 692 694 695 696 697 698 699 747 751 755 757 772 775 778
779 821 833 851 852 855 858 859 874 877 886 942 944 949

Area Code 916

322 323 324 325 328 329 331 332 334 338 344 361 362 363 364
366 369 371 372 381 383 386 388 391 392 393 395 421 422 423
424 427 428 440 441 442 443 444 445 446 447 448 449 451 452
453 454 455 456 457 481 482 483 484 485 486 487 488 489 635
638 643 648 665 682 685 687 689 722 723 725 726 728 731 736
739 766 771 781 782 783 786 791 797 920 921 922 924 925 927
929 933 944 961 962 965 966 967 969 971 972 973 985 988 989
991

Area Code 918

224 227 234 241 245 250 251 252 254 258 266 272 288 299 333
335 336 337 366 369 425 428 437 438 445 446 451 455 460 477
481 492 493 494 495 496 532 534 560 561 581 582 583 584 585
586 587 588 592 599 622 627 628 660 661 662 663 664 665 742
743 744 745 747 749 831 832 834 835 836 838

Area Code 919

271 272 273 274 275 279 282 288 292 294 299 373 375 377 378
379 595 621 622 643 656 668 674 680 685 697 698 721 722 723
724 725 727 730 744 748 750 760 761 764 765 766 767 768 769
770 773 777 784 785 788 852 854 855 922 924 945 969 983 993
994 996 998

Note: MCI also offers service to the following metropolitan areas in Canada. Listings for these area codes are not found in this appendix.

Area Code 403 - Calgary, Alberta

Area Code 416 - Toronto, Ontario

Area Code 514 - Montreal, Quebec

Area Code 613 - Ottawa, Ontario

APPENDIX D

AREA CODE AND PREFIX LISTING FOR GTE SPRINT NETWORK

<3 October 1983>

Area Code 201

221	222	224	225	226	227	228	229	231	232	233	235	238	239	241
242	245	246	247	249	251	254	256	257	259	261	262	263	265	266
267	268	272	273	276	277	278	279	283	284	285	287	288	289	291
297	298	299	321	324	325	326	327	328	329	330	332	333	334	335
338	339	340	342	343	344	345	348	351	352	353	354	355	356	358
359	360	361	365	366	368	371	372	373	374	375	376	377	379	381
382	384	385	386	387	388	389	390	391	392	393	394	399	420	423
427	428	429	430	432	433	434	435	436	437	438	440	441	442	444
445	447	450	451	455	456	457	460	461	463	464	465	467	468	469
470	471	472	473	474	478	480	481	482	483	484	485	486	487	488
489	493	494	495	499	522	523	524	526	527	530	531	533	538	539
540	541	542	543	544	545	546	547	548	549	558	560	561	564	565
567	568	569	570	571	572	573	574	575	581	582	585	589	592	595
596	599	621	622	623	624	625	627	628	631	632	634	635	636	641
642	643	645	646	648	649	652	653	654	656	658	659	661	662	664
665	666	667	668	670	671	672	673	674	675	676	677	678	679	684
685	686	687	688	690	692	694	695	696	699	721	722	724	725	727
731	733	736	738	740	741	742	743	744	745	746	747	748	750	751
752	753	754	755	756	757	759	760	761	762	763	765	766	767	768
772	773	777	778	779	783	784	785	787	789	790	791	792	794	795
796	797	798	820	821	822	823	824	825	826	828	833	834	836	837
842	843	844	845	846	851	854	857	858	861	862	863	864	865	866
867	868	869	870	871	873	874	877	878	880	881	882	884	885	886
887	890	893	894	895	898	923	925	926	930	931	932	933	934	935
936	937	939	941	942	943	944	945	946	947	949	952	953	956	957
961	963	964	965	966	967	968	969	975	976	977	981	983	984	985
989	991	992	993	994	997	998	999							

Area Code 202 ****Entire Area Code Is Served****

Area Code 203

222	223	224	225	226	227	229	232	233	234	236	239	241	242	243
244	246	247	248	249	252	254	255	259	261	262	263	264	265	266
268	269	270	271	272	273	274	275	277	278	279	281	282	283	284
285	286	288	289	322	323	324	325	326	327	328	329	332	333	334
335	336	348	354	355	356	357	358	359	366	367	368	371	372	373
374	375	377	378	382	384	385	386	387	389	393	397	426	431	432
436	438	452	467	468	469	481	484	488	492	493	494	495	497	521
522	523	524	525	527	528	529	531	544	547	548	549	552	561	562
563	565	566	568	569	573	574	575	576	579	582	583	584	589	591
593	594	621	622	623	624	625	627	628	629	633	637	643	644	647
649	651	653	655	656	658	659	661	666	667	668	673	674	677	678
683	688	693	721	722	723	724	725	726	727	728	729	743	744	746
747	748	753	754	755	756	757	758	762	771	772	773	775	776	777
783	784	785	786	787	789	792	793	794	795	796	797	799	827	828
834	838	846	847	852	853	854	865	866	869	871	872	874	875	877
878	879	891	892	893	926	929	932	933	934	937	938	944	945	947
964	965	966	967	968	972	976								

Area Code 205

226 250 251 252 254 261 262 263 264 265 269 271 272 277 279
281 284 285 288 293 320 321 322 323 324 325 326 327 328 342
343 344 361 365 399 424 425 426 428 431 432 433 436 438 452
456 457 460 470 471 473 476 477 478 479 491 497 567 569 583
591 592 595 599 626 631 633 640 645 647 648 649 653 655 660
661 663 664 665 666 668 669 672 674 675 676 678 679 681 690
694 699 741 744 770 780 781 783 785 786 787 788 791 798 822
823 832 833 834 836 838 841 849 853 854 856 860 868 870 871
877 879 923 925 928 933 934 938 939 942 945 951 956 967 969
972 973 979 987 988 991

Area Code 206

223 226 228 232 233 235 236 237 241 242 243 244 246 248 251
255 271 272 277 281 282 283 284 285 292 322 323 324 325 326
328 329 340 343 344 345 346 361 362 363 364 365 367 382 383
392 394 421 431 432 433 442 447 451 453 454 455 464 467 472
473 474 475 481 483 485 486 487 488 522 523 524 525 526 527
531 535 537 542 543 545 546 547 564 565 572 575 581 582 583
584 587 588 591 593 594 597 621 622 623 624 625 626 627 628
630 631 632 633 634 641 643 644 655 656 662 672 682 721 722
723 725 742 743 745 746 747 751 752 756 759 762 763 764 767
771 772 773 774 775 776 778 782 783 784 788 789 821 822 823
824 827 828 838 839 841 842 843 845 847 848 852 854 859 862
863 872 874 878 881 882 883 885 922 924 927 932 935 937 938
941 946 947 952 955 964 967 977 984 991 994 995 996 997

Area Code 207

688 761 766 767 772 773 774 775 780 781 797 799 829 839 846
854 856 865 871 883 892 955

Area Code 208

286 322 323 333 334 336 338 342 343 344 345 362 375 376 377
378 383 384 385 386 887 888 922 939

Area Code 209

221 222 224 225 226 227 228 229 233 237 247 251 252 255 264
266 268 275 276 291 292 294 297 298 299 431 432 435 436 439
441 442 443 445 449 453 462 463 464 465 466 467 473 474 477
478 485 486 487 488 521 522 523 524 526 527 529 537 538 545
571 572 575 576 577 578 579 834 864 869 883 888 931 941 942
943 944 946 948 951 952 957 982 983

Area Code 212 ****Entire Area Code Is Served****

Area Code 213 ****Entire Area Code Is Served****

Area Code 214

221 222 223 224 225 226 227 228 229 231 233 234 235 236 238
239 241 242 243 245 247 248 251 252 253 254 255 256 257 258
259 262 263 264 266 269 270 271 272 276 278 279 285 286 287
288 289 291 292 296 297 298 299 320 321 323 324 327 328 330
331 333 337 339 340 341 343 347 348 349 350 351 352 353 357
358 361 363 368 369 370 371 372 373 374 375 376 377 380 381
385 386 387 388 391 392 398 399 420 421 422 423 424 426 428
429 434 436 437 438 442 445 446 450 453 454 455 456 457 458
462 463 464 465 466 471 475 482 484 487 492 494 495 521 522
523 526 528 530 531 532 534 539 541 542 548 553 556 557 559
561 564 565 566 570 573 574 578 579 581 589 592 593 595 596
597 620 630 631 634 637 638 641 642 643 644 647 650 651 652
653 655 658 659 660 661 663 669 670 671 673 676 679 680 681

688 689 690 691 692 696 698 699 720 721 724 732 733 739 741
742 744 745 746 747 748 749 750 753 754 757 758 759 760 761
767 780 783 784 785 786 787 788 790 792 793 794 798 820 821
823 824 825 826 827 828 830 832 837 838 839 840 844 849 851
858 862 867 868 869 871 872 874 877 880 881 882 883 888 890
892 893 894 920 922 931 933 934 935 938 939 941 942 943 944
946 948 949 954 960 969 976 980 982 983 984 985 986 987 988
991 992 993 995 996 997

Area Code 215

221 222 223 224 225 226 227 228 229 231 232 233 235 236 237
238 241 242 243 244 245 247 248 250 251 252 253 256 258 259
261 262 263 264 265 266 268 270 271 272 274 275 276 277 278
279 282 283 284 285 286 287 288 289 291 293 296 298 299 320
322 324 328 329 331 332 333 334 335 336 337 338 339 341 342
343 346 349 351 352 353 355 356 357 358 359 362 364 365 368
371 372 373 374 375 376 378 379 382 386 387 388 389 395 398
422 423 424 425 426 427 432 433 434 435 437 438 439 441 443
444 446 447 448 449 452 455 456 457 459 461 462 463 464 465
466 467 468 471 472 473 474 476 477 481 482 483 484 485 487
488 489 491 492 494 495 496 497 499 521 522 525 527 528 532
533 534 535 537 539 540 542 543 544 545 546 547 548 549 552
557 561 562 563 564 565 566 567 568 569 572 574 576 578 581
582 583 584 585 586 587 589 592 595 596 597 598 622 623 624
625 626 627 628 629 630 631 632 634 635 636 637 638 639 640
641 642 643 644 645 646 647 648 649 657 659 661 662 663 664
665 666 667 668 670 671 672 673 674 675 676 677 678 682 683
684 686 687 688 689 691 693 694 697 698 699 722 724 725 726
727 728 729 732 734 735 739 742 743 744 745 747 748 749 750
751 752 753 755 757 759 763 765 767 768 769 770 775 776 777
779 781 782 783 784 785 786 787 788 789 791 796 797 799 820
821 823 824 825 828 829 831 833 834 835 836 837 838 839 841
842 843 844 846 848 849 853 854 855 856 860 861 864 865 866
867 868 872 874 875 876 877 878 879 884 885 886 887 891 893
894 895 896 897 898 921 922 923 924 925 926 927 928 929 933
934 935 936 937 938 943 944 945 946 947 948 949 951 952 962
963 964 965 966 967 968 969 972 976 977 978 985 987 988

Area Code 216

221 225 226 228 229 231 232 233 234 235 236 237 238 241 243
244 245 246 247 248 249 251 252 253 255 257 261 265 266 267
268 271 273 277 278 281 282 283 288 289 291 292 295 299 321
322 323 324 327 329 331 333 334 335 336 338 341 344 348 349
351 352 354 355 356 357 361 362 363 365 366 368 369 370 371
372 373 374 375 376 379 381 382 383 384 391 392 393 394 395
398 399 421 423 425 429 430 431 432 433 434 438 439 441 442
443 444 447 449 451 452 453 454 455 456 458 459 461 464 467
468 471 473 475 476 477 478 481 484 486 488 489 491 492 493
494 497 499 521 522 523 524 526 529 530 531 533 534 535 536
538 539 541 542 543 545 549 561 562 566 568 572 574 575 578
579 581 582 583 585 587 589 621 622 623 626 628 630 631 633
637 638 641 642 644 645 650 651 655 656 657 658 659 661 662
663 664 666 668 671 672 673 676 678 681 686 687 688 692 694
696 699 721 724 726 729 731 732 733 734 741 742 743 744 745
746 747 748 749 750 751 752 753 755 757 758 759 761 762 771
772 773 777 779 781 782 783 784 788 791 792 793 794 795 796
797 798 799 822 824 825 826 831 832 833 835 836 837 838 841
842 843 845 847 848 851 856 860 861 862 863 864 866 867 868
869 871 872 874 875 876 877 879 881 882 883 884 885 886 888
889 892 896 898 920 921 922 923 926 928 929 931 932 933 934
937 941 942 943 944 946 949 951 953 960 961 965 967 974 984
986 991

Area Code 217

328 332 333 337 344 351 352 356 359 364 367 373 384 398 422
423 424 425 428 429 469 483 485 487 488 492 495 496 498 522
523 525 528 529 544 546 564 566 568 582 583 586 595 598 626
629 636 643 684 687 688 694 747 753 767 782 785 786 787 788
789 793 863 867 875 877 892 893 896 897 963

Area Code 219

232 233 234 236 237 239 255 256 258 259 272 277 282 283 284
287 288 289 291 299 391 392 397 398 420 422 423 424 425 426
427 428 429 432 434 436 440 441 442 443 444 445 446 447 449
456 458 461 467 473 478 481 482 483 484 485 486 489 493 520
556 622 623 625 627 632 633 637 638 639 654 657 659 672 674
679 693 730 736 738 744 745 747 749 762 763 769 787 836 838
844 845 853 881 882 883 884 885 886 887 922 923 924 931 932
933 937 938 942 944 947 949 962 972 977 980 981 989

Area Code 301

222 224 225 227 229 231 232 233 234 235 236 237 238 239 242
243 244 247 248 249 251 252 254 255 256 258 260 261 262 263
265 266 267 268 269 270 276 277 279 281 282 283 284 285 288
291 292 294 295 296 297 298 299 320 321 322 323 325 327 328
329 332 335 336 337 338 340 341 342 343 344 345 350 353 354
355 356 358 362 363 365 366 367 368 372 377 379 383 384 385
386 388 390 391 393 394 396 420 421 422 423 424 426 427 428
429 431 433 434 435 436 437 439 441 442 443 444 445 448 449
454 455 459 460 461 462 464 465 466 467 468 469 472 474 477
481 483 484 485 486 488 490 492 493 494 495 496 497 498 521
522 523 525 526 528 529 530 531 532 534 536 537 539 542 544
547 549 551 552 557 559 561 563 564 565 566 567 568 569 572
574 575 576 577 578 583 585 587 588 589 592 593 594 595 596
597 598 599 621 622 624 625 627 628 629 630 633 636 644 646
647 649 652 653 654 655 656 657 659 661 664 665 666 667 668
669 672 674 675 677 679 681 682 683 685 686 687 688 699 721
725 727 728 730 731 732 735 736 741 744 747 748 752 753 757
760 761 762 763 764 765 766 768 770 771 772 773 774 776 779
781 787 788 789 792 793 794 795 796 798 799 821 823 825 828
833 837 839 840 841 843 844 849 850 851 852 853 854 855 856
859 864 866 867 868 869 870 871 875 876 877 878 879 881 882
888 889 890 891 894 897 899 921 922 923 924 925 926 927 929
933 935 936 937 942 944 945 946 947 948 949 951 952 953 955
956 962 963 964 967 969 972 973 974 977 981 982 983 984 986
987 988 992 995 997

Area Code 302

239 322 323 328 366 368 421 428 429 451 453 454 475 478 571
573 575 594 651 652 654 655 656 658 731 737 738 762 764 772
773 774 792 798 834 836 992 994 995 998 999

Area Code 303

221 223 224 226 229 230 231 232 233 234 235 237 238 239 273
277 278 279 284 287 288 289 291 292 293 294 295 296 297 298
320 321 322 329 330 333 337 339 340 341 343 344 350 351 352
353 355 356 360 361 363 364 366 367 370 371 373 377 382 388
390 392 393 394 398 399 420 421 422 423 424 425 426 427 428
429 430 431 433 440 441 442 443 444 447 449 450 451 452 454
455 457 458 465 466 469 471 472 473 475 477 480 481 482 484
488 491 492 493 494 495 497 499 526 530 534 535 538 542 543
544 545 546 547 549 551 560 561 564 566 568 570 571 572 573
574 575 576 577 578 579 584 587 590 591 592 593 594 595 596
597 598 599 620 623 624 628 629 630 631 632 633 634 635 636
639 642 649 650 651 652 654 659 665 666 670 671 673 674 678
681 684 685 686 687 688 690 691 692 693 694 695 696 697 698
699 722 733 737 740 741 744 750 751 752 753 755 756 757 758

759 761 762 770 771 772 773 776 777 778 779 781 785 789 790
791 792 793 794 795 796 797 798 799 820 821 823 825 826 830
831 832 834 837 839 841 850 851 855 861 863 866 869 890 892
893 894 896 898 922 934 935 936 937 938 947 948 972 973 976
977 978 979 980 985 986 987 988 989

Area Code 304
342 343 344 345 346 347 348 357 429 453 486 522 523 526 529
696 697 722 727 733 736 743 744 746 747 755 756 757 762 766
768 776 840 925 949 954 965 968 984

Area Code 305
221 223 226 232 233 235 238 241 243 245 246 247 248 251 252
253 255 257 258 261 262 263 264 266 270 271 272 274 276 278
279 280 284 285 324 325 326 343 350 353 357 358 361 368 371
372 373 374 377 379 381 382 384 385 386 387 389 391 392 393
395 398 399 421 426 427 428 429 431 432 433 434 435 439 441
442 443 444 445 446 447 448 449 454 456 457 458 462 463 467
471 472 473 474 475 476 482 483 484 485 486 487 488 490 491
492 493 495 498 499 521 522 523 524 525 526 527 528 529 531
532 533 534 537 538 541 543 544 545 547 548 550 551 552 553
554 556 557 558 559 561 563 564 565 566 573 576 577 578 579
580 581 582 583 584 585 586 587 588 591 592 593 594 595 596
598 620 621 622 623 624 625 626 627 633 634 635 637 638 642
643 649 650 651 652 653 655 659 661 662 665 666 667 672 673
674 681 683 684 685 686 687 688 689 691 693 694 696 721 722
726 731 732 733 734 735 736 737 739 741 742 744 746 747 748
749 751 752 753 754 755 756 757 758 759 761 762 763 764 765
766 769 771 772 776 781 782 785 786 791 792 793 797 798 821
822 823 825 829 832 833 835 836 837 838 840 842 844 845 848
854 856 858 861 863 864 865 866 868 871 873 874 883 884 885
887 888 891 893 895 899 920 921 922 923 925 926 927 928 929
931 932 935 936 937 939 940 941 942 943 944 945 946 947 948
949 952 961 962 963 964 965 966 967 968 969 971 972 973 974
975 979 981 983 985 987 989 994 997 998

Area Code 307
234 235 237 261 265 266 268 472 473 577 632 634 635 637 638
771 772 775 777 778

Area Code 309
362 565 637 655 671 672 673 674 675 676 679 682 685 686 688
690 691 692 693 694 697 698 699 745 751 752 755 757 762 764
786 787 788 792 793 794 796 797 798 799 822

Area Code 312 ****Entire Area Code Is Served**

Area Code 313
222 223 224 225 226 232 233 234 235 237 238 239 245 246 252
255 256 257 259 261 263 264 267 268 270 271 272 273 274 275
276 277 278 280 281 282 283 284 285 286 287 288 291 292 293
294 295 296 297 298 321 322 323 326 331 332 333 334 335 336
337 338 341 342 343 344 345 348 349 351 352 353 354 355 356
357 358 361 362 365 366 368 369 371 372 373 374 377 381 382
383 386 388 389 391 393 397 398 399 420 421 422 423 424 425
426 427 428 429 430 434 435 437 439 442 444 445 446 449 451
453 455 456 459 463 464 465 466 467 468 469 471 472 473 474
475 476 477 478 479 481 482 483 484 485 486 487 491 492 493
494 495 496 497 499 521 522 523 524 525 526 527 528 531 532
533 534 535 536 537 538 539 540 541 542 543 544 545 546 547
548 549 551 552 553 554 556 557 559 561 562 563 564 565 566
567 568 569 571 572 573 574 575 576 577 579 581 582 583 584

585 588 589 591 592 593 594 595 621 624 626 629 631 635 636
637 640 641 642 643 644 645 646 647 649 653 655 658 659 661
662 663 665 668 669 671 675 676 681 682 683 686 687 689 694
695 697 699 721 722 723 728 729 732 733 735 736 738 742 743
744 750 751 754 755 756 757 758 759 761 762 763 764 766 767
768 769 771 772 773 774 775 776 777 778 779 785 787 789 791
792 821 822 823 824 826 827 828 831 832 833 834 835 836 837
838 839 841 842 843 846 847 848 849 851 852 853 855 856 857
858 861 862 863 864 865 866 867 868 869 871 872 873 874 875
876 879 881 882 883 884 885 886 888 891 892 893 894 895 896
897 898 899 921 922 923 924 925 926 927 928 931 932 933 934
935 937 939 941 942 943 946 949 956 961 962 963 964 965 967
968 971 972 973 976 977 978 979 981 994 995 996

Area Code 314

225 227 231 232 233 234 241 247 253 261 263 275 289 291 296
321 342 343 344 351 352 353 355 361 367 371 381 382 383 385
388 389 391 394 421 423 425 426 427 428 429 432 434 436 441
444 447 454 458 464 469 481 487 521 522 524 525 531 532 533
534 535 544 553 554 567 569 572 576 577 595 621 622 631 638
644 645 647 652 658 664 671 677 679 694 721 723 724 725 726
727 731 739 741 752 768 771 772 773 776 777 781 821 822 823
826 831 832 837 838 839 842 843 846 849 851 854 855 862 863
865 867 868 869 872 878 889 892 894 895 899 921 922 925 928
938 942 946 947 957 961 962 964 965 966 968 969 982 991 993
994 997

Area Code 315

421 422 423 424 425 426 428 432 433 437 445 446 451 452 454
455 456 457 458 463 468 469 470 471 472 473 474 475 476 477
478 479 487 488 492 524 592 593 598 622 623 625 633 635 636
637 638 640 652 655 656 662 668 672 673 675 676 677 678 682
683 685 687 689 695 696 697 699 724 732 733 735 736 737 738
768 792 793 797 798 822 831 839 841 853 859 865 890 896 963
986

Area Code 316

261 262 263 264 265 266 267 268 269 436 522 524 526 529 574
681 682 683 684 685 686 687 688 689 721 722 733 744 755 772
773 775 776 777 778 788 794 796 799 832 838 942 943 945 946

Area Code 317

222 228 232 233 235 236 239 240 241 242 243 244 247 248 251
252 253 255 256 257 259 261 262 263 264 265 266 267 269 271
272 273 282 283 284 285 286 288 289 291 293 297 298 299 326
335 352 353 354 356 357 358 359 378 395 396 422 452 453 455
456 457 459 462 467 468 485 533 534 535 536 539 542 543 545
546 547 549 552 556 560 562 566 630 631 632 633 634 635 636
637 638 639 642 643 644 646 648 649 689 724 734 736 738 741
745 747 754 755 759 768 769 773 774 776 778 779 782 783 784
786 787 788 789 823 831 835 838 839 842 844 845 846 848 849
852 856 861 862 871 872 873 875 877 878 881 882 883 887 888
892 894 896 897 898 899 923 924 925 926 927 928 929 945 947
963 994 996

Area Code 318

221 222 226 227 231 232 233 234 235 236 237 261 264 269 294
424 425 433 436 439 456 459 474 477 478 491 494 527 528 582
598 625 631 632 635 636 670 674 683 686 687 688 742 746 747
797 798 837 855 856 861 865 868 869 873 882 896 925 929 933
938 949 965 981 984 987 988 989

Area Code 319

225 282 284 285 289 322 323 324 326 332 344 349 355 359 362
363 364 365 366 369 373 378 381 383 386 388 390 391 393 395
396 398 399 438 455 842 846 848 849 851 854 857 895

Area Code 401

224 231 232 245 246 247 253 255 272 273 274 275 276 277 278
331 333 334 351 353 397 421 431 433 434 437 438 456 457 461
463 464 467 521 525 528 572 574 621 624 625 635 647 722 723
724 725 726 727 728 732 737 738 739 751 776 781 785 821 822
823 825 826 827 828 831 861 863 865 884 885 886 934 941 942
943 944 949 955

Area Code 402

221 238 241 253 271 280 289 291 292 293 294 330 331 332 333
334 339 341 342 344 345 346 347 348 359 390 391 392 393 397
398 399 421 422 423 435 444 449 451 453 455 457 464 466 467
470 471 472 473 474 475 476 477 483 488 489 493 494 496 498
536 541 551 553 554 556 558 559 571 572 592 593 633 691 731
733 734 742 779 780 781 782 783 784 785 786 787 788 789 790
791 792 794 795 796 797 798 799 894 895 896 962 977 978 987

Area Code 404

221 223 231 233 237 238 239 241 243 244 247 252 255 256 257
261 262 266 284 286 288 289 292 294 296 299 320 321 325 329
344 346 349 351 352 353 354 355 361 362 363 366 371 373 377
378 391 393 394 396 398 399 420 422 424 425 426 427 428 429
432 433 434 435 436 441 442 445 446 447 448 449 451 452 454
455 457 458 461 463 466 469 471 474 475 476 477 478 482 483
487 489 491 493 496 498 521 522 523 524 525 526 527 529 530
533 542 543 546 548 549 564 572 577 581 586 587 588 622 624
627 633 634 636 653 656 658 659 681 688 691 696 699 725 739
741 742 743 752 753 755 758 759 761 762 763 765 766 767 768
769 783 788 789 792 794 795 797 799 843 871 872 873 874 875
876 879 881 885 890 892 894 897 898 899 921 922 923 925 926
928 929 931 934 935 936 937 938 939 941 942 943 944 945 946
948 949 951 952 953 955 956 957 961 962 963 964 968 969 971
972 973 974 976 977 979 981 982 987 991 992 993 996 997 998
999

Area Code 405

231 232 235 236 239 270 271 272 278 292 321 324 325 329 340
341 348 350 354 360 364 366 373 376 381 390 391 396 399 424
427 460 478 491 495 521 523 524 525 528 556 557 599 630 631
632 634 636 670 672 677 681 682 685 686 691 721 722 728 732
733 734 736 737 745 751 752 755 769 771 781 787 789 793 794
799 840 841 842 843 848 942 943 946 947 948 949 990 996

Area Code 408

224 225 226 227 238 241 243 244 245 246 247 248 249 251 252
253 255 256 257 258 259 262 263 264 265 266 267 268 269 270
272 274 275 277 279 280 281 284 286 287 288 289 291 292 293
294 295 296 297 298 299 335 336 338 353 354 356 358 365 370
371 374 377 378 379 395 399 422 423 424 425 426 427 429 438
443 446 448 449 455 458 462 463 475 476 479 484 491 496 554
559 575 578 629 633 662 663 675 679 688 720 721 723 725 727
729 730 732 733 734 735 736 737 738 739 741 742 743 744 745
746 747 748 749 754 755 756 757 758 773 865 866 867 920 923
925 926 942 943 945 946 947 970 971 972 973 977 978 980 984
985 986 987 988 993 994 995 996 997 998

Area Code 409

231 260 264 268 272 273 291 294 295 361 362 539 560 564 569
582 588 589 684 693 696 722 724 727 735 736 737 740 744 752
753 755 756 760 761 762 763 764 765 766 768 769 775 779 786
794 796 822 823 832 833 835 838 839 842 845 846 860 866 882
883 886 892 898 899 925 935 938 942 945 948 962 963 982 983
985 986 989

Area Code 412

221 227 231 232 234 237 241 242 243 244 247 255 256 257 261
262 263 264 269 271 273 276 279 281 288 321 322 323 331 333
341 343 344 351 355 359 361 362 363 364 366 367 371 372 373
374 381 391 392 393 394 421 422 429 431 433 434 441 442 456
461 462 464 466 469 471 481 486 487 488 521 531 546 553 561
562 563 565 566 571 578 596 621 622 624 633 636 642 644 647
648 653 655 661 664 665 672 673 675 678 681 682 683 687 731
734 741 751 754 761 765 766 767 771 777 778 781 782 784 787
788 793 795 821 822 823 824 825 828 829 831 833 835 840 854
855 856 859 863 864 881 882 884 885 892 921 922 923 928 931
936 937 961 963 967 976

Area Code 413

525 532 533 534 536 538 539 543 547 557 562 566 567 568 569
575 583 589 592 593 594 596 598 730 732 733 734 736 737 739
781 782 783 785 786 787 788 789 955

Area Code 414

224 225 226 228 241 242 243 246 251 252 255 257 258 259 263
264 265 271 272 273 274 276 277 278 281 282 289 291 321 327
332 336 337 342 344 347 351 352 353 354 355 357 358 367 372
374 375 377 383 384 399 421 422 423 425 432 433 434 435 436
437 438 442 444 445 447 449 453 456 461 462 463 464 465 466
468 469 475 476 481 482 483 494 497 498 499 527 529 535 541
542 543 544 545 546 547 548 549 551 552 553 554 562 631 632
633 634 636 637 639 643 645 647 649 652 654 656 657 658 662
671 672 678 679 681 691 694 697 744 747 761 762 764 765 768
769 771 774 778 781 782 783 784 785 786 797 798 799 822 826
833 835 843 844 845 857 859 863 864 865 866 869 871 873 878
886 899 931 933 935 936 937 961 962 963 964

Area Code 415 ****Entire Area Code Is Served****

Area Code 419

240 241 242 243 244 245 246 247 248 249 255 259 381 382 385
389 470 471 472 473 474 475 476 478 521 522 524 525 526 529
531 534 535 536 537 589 661 666 691 693 698 726 727 729 747
755 756 825 826 829 836 837 838 841 855 862 865 866 867 872
874 877 878 882 883 884 885 886 891 892 893 895 896 936

Area Code 501

223 224 225 227 370 371 372 373 374 375 376 378 433 455 490
562 565 568 569 645 653 660 661 663 664 666 732 735 753 758
771 772 773 774 821 834 835 847 851 868 888 897 945 961 982
985 988

Area Code 502

222 228 231 239 241 244 245 267 361 363 366 367 368 423 425
426 429 447 448 449 451 452 454 456 458 459 491 499 540 560
561 562 566 568 569 571 580 581 582 583 584 585 587 588 589
634 635 636 637 772 774 775 776 778 893 895 896 897 922 933
935 937 955 957 964 966 967 968 969

Area Code 503

220 221 222 223 224 225 226 227 228 229 230 231 232 233 234
235 236 237 238 239 240 241 242 243 244 245 246 248 249 251
252 253 254 255 256 257 280 281 282 283 284 285 286 287 288
289 292 293 294 295 297 299 362 363 364 370 371 373 378 390
393 399 581 585 588 620 621 625 626 627 628 629 630 631 632
635 636 637 638 639 640 641 642 643 644 645 646 647 648 649
650 652 653 654 655 656 657 658 659 661 663 665 666 667 668
681 682 684 685 692 695 741 743 749 760 761 771 774 775 777
790 796 844

Area Code 504

241 242 244 245 246 254 255 260 261 262 271 272 273 275 277
278 279 282 283 286 288 291 292 293 334 340 341 342 343 344
346 347 348 349 355 356 357 358 359 361 362 363 364 366 367
368 377 379 381 382 383 387 388 389 391 392 393 394 399 431
436 441 443 450 454 455 456 464 466 467 468 469 482 483 484
486 488 521 522 523 524 525 527 528 529 561 563 566 568 569
575 581 586 587 588 589 594 595 596 627 642 654 656 662 664
665 676 682 684 686 689 733 734 737 738 749 766 767 769 771
774 775 778 821 822 826 827 831 832 833 834 835 837 838 851
861 865 866 868 872 873 876 879 885 887 888 889 891 895 896
897 899 922 923 924 925 926 927 928 942 943 944 945 947 948
949 976

Area Code 505

242 243 247 255 256 262 265 266 268 277 281 291 292 293 294
296 298 299 344 345 678 679 765 766 821 822 823 824 831 836
841 842 843 844 846 848 865 867 869 873 877 881 883 884 888
892 893 897 898

Area Code 507

281 282 284 285 286 287 288 289 356 365 367 533 545 597 753
755 775 867 876 932

Area Code 512

220 221 222 223 224 225 226 227 228 229 230 231 233 241 242
243 244 246 247 250 251 255 258 259 261 262 263 264 265 266
267 270 271 272 276 281 282 288 289 299 327 328 329 333 337
340 341 342 343 344 345 346 349 350 366 372 379 381 383 385
387 390 397 399 421 423 425 428 432 433 434 435 436 441 442
443 444 445 447 448 451 452 453 454 458 459 464 465 467 469
470 471 472 473 474 475 476 477 478 479 480 482 492 493 494
495 496 497 531 532 533 534 536 541 542 544 546 548 560 572
573 575 576 578 581 585 621 622 623 624 625 626 627 628 629
630 631 633 635 636 639 643 647 648 649 650 651 652 653 654
655 656 657 658 659 661 662 667 670 671 673 674 675 677 679
680 681 682 684 686 687 688 690 691 692 694 695 696 698 699
722 723 724 726 727 732 733 734 735 736 737 748 781 787 797
820 821 822 824 826 828 831 834 835 836 837 838 843 845 851
852 853 854 855 857 870 881 882 883 884 886 887 888 892 921
922 923 924 925 926 927 928 929 933 937 939 943 991 992 993

Area Code 513

220 221 222 223 224 225 226 227 228 229 231 232 233 234 236
237 241 242 243 244 245 247 248 251 252 253 254 255 256 257
258 259 262 263 265 267 268 271 272 274 275 276 277 278 281
290 293 294 296 297 298 299 321 322 323 324 325 327 328 346
347 351 352 353 367 369 381 385 388 389 390 396 397 399 420
421 422 423 424 425 426 429 433 434 435 439 443 445 449 451
454 457 461 462 467 471 474 475 476 481 482 489 499 521 522
527 528 530 531 533 536 539 541 542 551 553 554 559 561 562
563 565 566 568 569 574 575 576 579 583 589 591 595 598 621

624 625 627 629 631 632 641 651 659 661 662 667 671 677 681
683 684 721 722 724 729 731 732 733 734 738 741 742 743 745
746 748 749 751 752 753 756 761 762 763 765 769 771 772 777
779 782 786 787 791 793 797 820 821 822 825 828 829 831 832
835 836 837 841 845 848 849 851 852 853 854 859 861 862 863
864 865 866 867 868 870 871 872 873 874 878 879 882 885 890
891 896 898 921 922 923 931 941 943 948 961 964 969 972 977
984 988

Area Code 515
223 224 225 242 243 244 245 246 247 255 262 263 265 266 270
271 274 276 277 278 279 280 281 282 283 284 285 286 287 288
289 834 961 964 965 966 967 981 984 986 987 989 992 993 996
999

Area Code 516 ****Entire Area Code Is Served**

Area Code 517
321 322 323 332 337 339 349 351 353 355 363 371 372 373 374
377 393 394 482 483 484 485 487 625 626 627 641 645 646 651
655 663 669 675 676 694 699 882 887

Area Code 518
235 237 266 270 271 272 273 274 279 283 286 346 355 356 370
371 372 374 377 381 382 383 384 385 386 393 399 434 436 438
439 445 447 449 453 454 455 456 457 458 459 462 463 465 470
471 472 473 474 475 476 477 482 489 584 587 663 664 674 731
732 753 756 765 766 767 768 783 785 797 861 864 869 872 877
882 885 890 895 899

Area Code 601
342 352 353 354 355 359 362 366 371 372 373 376 393 641 781
825 829 845 851 852 856 857 866 878 879 922 923 924 932 936
939 944 948 949 956 957 960 961 968 969 981 982 987 992

Area Code 602
224 231 233 234 235 236 237 238 239 241 242 243 244 245 246
247 248 249 251 252 253 254 255 256 257 258 259 260 261 262
263 264 265 266 267 268 269 270 271 272 273 274 275 276 277
278 279 285 292 293 294 295 296 297 298 299 323 325 326 327
435 551 569 573 574 575 576 577 578 581 582 583 584 585 588
589 620 621 622 623 624 626 628 629 721 741 742 743 744 745
746 747 748 749 790 791 792 795 820 827 829 830 831 832 833
834 835 837 838 839 840 841 842 843 846 848 849 853 856 860
861 862 863 864 866 867 869 870 872 873 876 877 878 879 880
881 882 883 884 885 886 887 888 889 890 891 892 893 894 895
897 898 899 921 924 931 932 933 934 935 936 937 938 939 941
942 943 944 945 946 947 948 949 951 952 953 954 955 956 957
961 962 963 964 965 966 967 968 969 971 972 973 974 975 976
977 978 979 981 982 983 984 985 986 987 988 990 991 992 993
994 995 996 997 998

Area Code 603
424 429 432 434 463 465 472 483 485 487 497 529 622 623 624
625 627 635 645 666 668 669 673 880 881 882 883 884 885 886
888 889 890 893 894 898 955

Area Code 605
331 332 333 334 335 336 338 339 361 371 477 528 529 543 582
594 743 757

Area Code 606

223 231 232 233 252 253 254 255 257 258 259 261 266 268 269
272 273 276 277 278 283 291 292 293 299 331 334 341 342 344
356 371 384 397 431 441 485 491 525 565 566 572 581 586 628
635 689 727 781 846 858 873 885 887 936 939

Area Code 607

648 655 669 692 722 723 724 729 748 751 752 754 755 757 770
771 772 773 774 775 785 797 798 862 890

Area Code 608

221 222 231 233 238 241 244 246 249 251 252 255 256 257 258
262 263 264 266 267 271 273 274 275 283 291 424 437 455 592
635 655 764 767 798 829 831 832 833 835 836 837 838 839 845
846 849 873 936 993

Area Code 609

234 235 259 266 275 292 298 338 340 342 344 345 347 348 354
365 391 392 393 394 395 396 398 399 424 426 428 429 441 443
448 452 456 466 482 484 487 488 541 546 547 573 581 585 586
587 590 599 633 639 641 645 646 652 653 655 662 663 665 667
683 695 734 737 742 755 757 771 772 778 779 786 795 799 822
823 829 854 858 866 882 883 888 890 896 921 924 927 931 933
936 939 962 963 964 966 976 984 987 989 999

Area Code 612

221 222 224 225 226 227 228 291 292 293 296 297 298 330 331
332 333 338 339 340 341 343 344 347 348 349 370 371 372 373
374 375 376 377 378 379 420 421 422 423 424 425 426 427 428
429 430 431 432 433 434 435 436 437 438 439 441 443 444 445
446 447 448 450 451 452 454 455 456 457 458 459 460 461 462
463 464 469 471 472 473 474 475 476 477 478 479 481 482 483
484 487 488 489 492 497 498 520 521 522 529 533 534 535 536
537 538 540 541 542 544 545 546 553 559 560 561 566 571 572
574 588 620 622 623 631 633 635 636 638 641 642 644 645 646
647 648 681 690 696 698 699 721 722 724 725 726 727 729 731
733 735 736 738 739 742 753 755 757 770 771 772 774 776 777
778 779 780 781 784 786 788 789 822 823 824 825 827 828 830
831 835 851 853 854 858 861 866 869 870 871 872 874 881 884
885 887 888 890 893 894 920 921 922 924 925 926 927 929 931
932 933 934 935 936 937 938 941 944 989

Area Code 614

221 222 223 224 225 227 228 229 231 235 236 237 238 239 251
252 253 258 261 262 263 265 267 268 272 274 275 276 278 279
281 291 294 297 299 421 422 424 431 436 438 443 444 445 451
457 459 460 461 462 463 464 466 469 471 475 476 481 486 488
491 492 497 548 764 766 771 821 833 836 837 846 855 860 861
863 864 866 867 868 870 871 875 876 877 878 879 881 882 885
886 888 889 890 891 894 895 927 965

Area Code 615

226 227 228 236 238 242 244 248 251 254 255 256 259 262 265
266 267 269 292 297 298 320 321 322 327 329 331 332 333 344
352 353 356 360 361 366 367 373 377 383 385 386 396 521 522
523 524 525 544 546 558 573 577 579 584 588 622 624 629 632
637 642 646 656 673 687 688 689 690 691 693 694 697 698 737
741 742 747 748 749 751 752 754 755 756 757 758 776 778 780
782 790 791 793 794 799 821 822 824 825 832 833 834 842 843
847 855 859 860 865 867 868 870 875 876 877 883 885 886 889
892 894 899 922 933 938 945 947 966 971 974 992

Area Code 616

241 242 243 245 246 247 281 323 327 329 342 343 344 345 349
361 363 364 372 375 381 382 383 384 385 388 451 452 453 454
455 456 457 458 459 530 531 532 534 538 623 624 626 628 629
649 657 664 665 668 669 671 676 677 679 681 685 691 692 694
698 731 746 770 774 784 791 837 866 868 874 877 878 887 891
895 896 897 899 942 949 957

Area Code 617

222 223 225 226 227 229 231 232 233 235 236 237 241 242 243
244 245 246 247 250 251 252 253 254 256 258 259 262 265 266
267 268 269 271 272 273 274 275 276 277 282 284 285 286 287
288 289 292 296 298 321 322 323 324 325 326 327 328 329 331
332 333 335 336 337 338 339 341 344 351 352 353 354 357 358
361 364 365 366 367 368 369 370 371 376 379 381 383 387 389
391 392 393 395 396 399 421 422 423 424 426 427 429 431 434
436 437 438 442 444 445 449 451 452 453 454 458 459 461 463
466 469 470 471 472 475 479 482 483 484 488 489 491 492 494
495 497 498 522 523 524 527 536 542 547 552 561 566 567 569
574 575 576 577 578 579 580 581 583 584 586 587 588 589 592
593 594 595 596 598 599 620 623 625 628 633 636 637 638 641
642 643 644 646 647 648 649 651 653 654 655 657 658 661 662
663 664 665 666 667 669 671 672 673 674 675 676 678 679 681
682 683 684 685 686 687 688 689 692 695 696 698 699 720 721
722 723 725 726 727 729 731 732 734 735 738 739 740 742 743
749 752 753 754 755 756 757 758 761 762 763 767 769 770 773
776 781 782 783 785 786 787 788 791 792 793 794 798 799 821
825 828 829 832 835 839 842 843 845 846 847 848 849 851 852
853 855 856 858 860 861 862 863 864 865 868 869 870 872 875
876 877 879 881 882 884 885 886 889 890 891 892 893 894 895
899 923 924 925 926 929 931 933 935 936 937 938 942 944 955
956 957 961 963 964 965 967 969 973 986 987 990 991 992 993
994 995 996 997 998 999

Area Code 618

271 274 337 451 452 797

Area Code 619

221 222 223 224 225 226 229 230 231 232 233 234 235 236 237
238 239 260 262 263 264 265 266 267 268 270 271 272 273 274
275 276 277 278 279 280 281 282 283 284 286 287 289 290 291
292 293 294 295 296 297 298 299 320 321 323 324 325 327 328
340 341 342 343 345 346 347 393 396 397 398 399 420 421 422
423 424 425 426 427 428 429 430 433 434 435 436 437 438 439
440 442 443 444 445 447 448 449 450 451 452 453 454 455 456
457 458 459 460 461 462 463 464 465 466 469 470 471 474 475
477 479 480 481 483 484 485 486 487 488 489 507 514 560 561
562 563 564 565 566 568 569 570 571 573 574 575 576 578 579
580 582 583 584 586 588 589 601 690 691 692 693 695 696 697
698 699 701 702 717 721 722 724 725 726 727 729 741 742 743
744 745 746 747 748 749 753 755 756 757 758 789 940 941 942

Area Code 702

246 293 294 295 321 322 323 329 331 342 343 345 348 355 356
358 359 361 362 363 367 368 369 381 382 383 384 385 386 387
389 399 451 452 453 454 456 457 458 459 475 476 564 565 566
634 642 643 644 645 646 647 648 649 673 677 731 732 733 734
735 736 737 739 747 784 785 786 787 788 789 793 796 798 825
826 827 829 831 832 833 844 847 849 851 852 853 870 871 873
876 877 878 882 883 884 885 887 926 928 971 972

Area Code 703

222 235 237 241 243 247 250 255 256 273 274 276 278 280 281
284 285 321 323 325 329 339 342 343 344 345 351 352 354 355
356 360 362 366 370 375 378 379 380 384 385 387 389 425 430
435 437 442 448 450 451 455 471 476 486 487 521 522 524 525
527 528 532 533 534 536 538 548 549 550 553 556 557 558 560
561 563 569 573 578 591 620 631 642 644 660 661 664 671 683
684 685 690 691 698 734 750 751 756 759 765 768 772 774 780
781 790 820 821 823 827 830 836 838 841 845 849 860 876 883
890 892 893 920 922 929 931 938 941 947 954 960 968 971 974
977 978 979 981 982 985 986 989 992 998

Area Code 704

331 332 333 334 335 336 364 365 366 370 371 372 373 374 375
376 377 378 379 392 393 394 398 399 455 523 525 527 535 536
537 541 542 545 552 553 554 563 567 568 570 588 594 596 597
598 821 825 827 840 843 847 875 882 889 892

Area Code 707

422 425 426 427 429 431 433 437 438 446 447 448 523 525 526
527 528 538 539 542 544 545 546 552 553 554 557 575 576 578
584 585 642 643 644 646 648 664 745 746 762 763 765 778 792
795 823 829 833 838 864 887

Area Code 712

233 239 252 255 258 274 276 277 279 322 323 325 328 347 366
746 777 938 943

Area Code 713

220 221 222 223 224 225 226 227 228 229 230 235 236 237 240
241 247 261 266 270 271 277 280 284 285 320 324 328 331 332
333 334 337 338 339 341 342 343 346 350 351 353 354 356 358
359 360 363 367 370 371 373 376 383 388 390 391 392 393 420
422 424 425 426 427 428 431 432 433 434 436 437 438 439 440
441 442 443 444 445 446 447 448 449 450 451 452 453 454 455
456 457 458 459 460 461 462 463 464 465 466 467 468 469 470
471 472 473 474 475 476 477 479 480 481 482 483 484 485 486
487 488 489 490 491 492 493 494 495 496 497 498 499 520 521
522 523 524 525 526 527 528 529 530 531 537 540 541 546 549
550 551 552 556 558 561 568 578 580 583 586 590 591 596 599
620 621 622 623 626 627 629 630 631 633 635 640 641 643 644
645 649 650 651 652 654 656 658 659 660 661 662 663 664 665
666 667 668 669 670 671 672 673 674 675 676 678 679 680 681
682 683 686 688 690 691 692 694 695 697 699 720 721 723 726
728 729 731 733 734 738 739 741 747 748 749 750 751 754 757
759 771 772 774 776 777 778 780 781 782 783 784 785 788 789
790 791 792 795 797 799 820 821 827 840 841 844 847 850 852
859 861 862 863 864 868 869 870 871 877 878 879 880 884 888
890 893 895 896 920 921 923 924 926 928 929 930 931 932 933
937 939 940 941 943 944 946 947 951 952 953 954 955 956 957
960 961 965 966 972 973 974 975 976 977 978 980 981 984 987
988 991 993 995 996 997 998 999

Area Code 714

220 240 241 250 261 321 350 351 354 359 361 369 370 380 381
382 383 384 385 391 431 432 441 472 474 476 492 493 494 495
496 497 498 499 502 503 505 509 517 520 521 522 523 524 525
526 527 528 529 530 531 532 533 534 535 536 537 538 539 540
541 542 543 544 545 546 547 548 549 550 551 552 553 554 556
557 558 559 567 579 581 586 591 592 593 594 595 596 597 598
599 602 620 621 622 623 624 625 626 627 628 629 630 631 632
633 634 635 636 637 638 639 640 641 642 643 644 645 646 649
650 651 660 661 662 667 669 670 671 673 675 680 681 682 683

684 685 686 687 688 689 707 708 710 712 720 730 731 732 738
739 740 742 750 751 752 754 756 758 759 760 761 768 770 771
772 773 774 775 776 777 778 779 780 781 783 784 785 786 787
788 790 792 793 794 795 796 797 798 820 821 822 823 824 825
826 827 828 829 830 831 832 833 834 835 836 837 838 839 840
841 842 846 847 848 850 851 852 855 856 857 859 861 863 865
870 871 874 875 877 879 880 881 882 883 884 885 886 887 888
889 891 892 893 894 895 896 897 898 899 921 937 946 947 951
952 953 954 955 956 957 960 961 962 963 964 966 968 969 970
971 972 973 974 975 977 978 979 980 981 982 983 984 985 986
987 988 989 990 991 992 993 994 995 996 997 998 999

Area Code 716

222 223 225 227 232 235 236 238 244 247 248 254 258 262 263
265 266 271 275 278 282 283 286 288 293 297 323 325 328 334
337 338 342 352 359 377 381 385 392 395 398 422 423 424 425
426 427 428 433 434 436 439 442 454 457 458 461 464 467 473
475 477 482 494 496 533 537 538 542 544 546 549 582 586 588
592 594 621 624 625 626 627 631 632 633 634 635 636 637 644
647 648 649 652 654 655 656 662 663 668 671 674 675 681 683
684 685 686 687 688 689 690 691 692 693 694 695 696 722 724
726 731 741 745 751 754 759 773 791 821 822 823 824 825 826
827 828 831 832 833 834 835 836 837 838 839 842 843 845 846
847 849 852 853 854 855 856 862 865 872 873 874 875 876 877
878 879 881 882 883 884 885 886 887 889 890 891 892 893 894
895 896 897 898 921 924 937 941 947 955 964 974 976 987 992

Area Code 717

225 232 233 234 236 238 244 246 252 255 266 283 284 285 287
288 291 292 295 299 333 342 343 344 346 347 348 354 378 383
392 393 394 397 457 464 469 472 474 489 533 534 545 558 560
561 562 563 564 566 569 586 587 599 626 627 639 652 653 654
655 656 657 663 664 665 675 678 687 689 691 693 696 697 698
732 735 736 737 741 755 757 761 763 764 766 767 768 771 774
779 780 782 783 786 787 790 792 822 823 824 825 826 829 842
843 845 846 848 854 868 872 876 896 898 921 938 939 944 945
948 957 961 969 975 986

Area Code 801

224 225 226 227 237 250 254 255 261 262 263 264 265 266 268
272 277 278 292 295 298 299 321 322 328 350 355 359 363 364
366 373 374 375 377 378 379 392 393 394 399 423 451 465 466
467 479 482 483 484 485 486 487 489 521 522 524 526 530 531
532 533 534 535 536 537 538 539 544 546 551 561 562 566 569
571 572 581 582 583 584 585 588 621 625 626 627 731 754 756
768 773 776 777 782 785 798 825 942 943 964 965 966 967 968
969 972 973 974 975

Area Code 803

232 233 235 239 242 243 244 246 252 254 256 268 269 271 277
281 282 288 292 294 295 297 298 299 345 353 355 356 359 433
439 461 463 472 474 476 552 553 554 556 559 571 572 573 574
576 577 578 579 582 583 585 588 592 596 722 723 724 731 732
733 735 736 738 742 743 744 745 747 748 751 754 755 758 762
763 764 765 766 767 768 771 772 776 777 779 781 782 783 786
787 788 791 792 794 795 796 797 798 799 831 834 836 845 855
859 862 871 873 875 877 879 881 883 884 886 889 895 945 963
967

Area Code 804

222 225 226 230 231 232 233 237 244 245 247 254 257 261 262
264 266 268 270 271 272 274 275 276 281 282 284 285 286 288
289 293 295 296 320 321 323 328 329 340 343 344 345 346 353

355 358 359 363 379 380 393 396 397 398 399 420 421 422 423
424 425 426 427 428 433 440 441 444 445 446 455 460 461 463
464 465 466 467 468 480 481 482 483 484 485 486 487 488 489
490 494 495 496 497 499 533 543 545 547 583 587 588 592 595
596 599 622 623 624 625 627 628 629 643 644 648 649 666 667
686 721 722 723 727 728 730 737 739 740 741 743 744 745 746
747 748 749 752 764 771 772 775 780 781 782 784 786 788 790
794 795 796 798 823 825 826 827 838 840 850 851 853 855 857
858 865 867 868 872 874 877 878 887 888 898 924 954 971 973
977 978 979

Area Code 805

213 322 323 324 325 326 327 329 366 373 388 392 393 395 397
398 399 482 483 484 485 486 487 488 492 493 494 495 496 497
498 499 522 523 525 526 527 529 581 583 584 589 629 642 643
644 647 648 649 652 653 654 656 658 659 831 832 833 834 835
842 845 854 858 861 871 872 933 982 983 984 985 986 987

Area Code 806

320 335 352 353 355 358 359 372 373 374 376 378 381 383 622
655 656 741 742 743 744 745 746 747 762 763 765 792 793 794
795 796 797 799 828 829 832 842 863 866 873 885 892

Area Code 808

235 237 239 247 254 257 259 261 262 263 293 373 377 395 396
422 423 433 438 449 455 456 471 474 477 486 487 488 499 521
523 524 525 526 527 528 531 533 536 537 538 543 544 545 546
547 548 595 621 622 623 624 625 637 638 653 655 668 671 672
676 677 681 682 684 687 689 695 696 732 734 735 737 833 834
836 839 841 842 845 847 848 922 923 926 941 942 943 944 945
946 947 948 949 955 988

Area Code 812

246 256 282 283 284 288 332 333 334 335 336 337 339 422 423
424 425 426 428 429 451 464 473 474 476 477 479 556 637 775
776 824 825 837 838 853 858 867 872 876 892 897 923 925 944
945 948 949 963 983 985 988

Area Code 813

221 223 224 225 226 227 228 229 231 232 234 236 237 238 239
241 242 247 248 251 253 254 256 257 258 259 272 273 621 622
623 626 634 645 650 659 677 681 684 685 689 830 831 832 833
834 835 837 839 840 855 870 871 872 873 875 876 877 879 883
884 885 886 887 920 932 933 935 949 961 962 963 969 971 972
973 974 977 985 986 988 989 990 996

Area Code 814

451 452 453 454 455 456 459 474 476 684 695 696 725 732 734
739 742 774 796 825 833 838 864 866 868 871 875 886 898 899
942 943 944 946 949

Area Code 815

226 229 234 282 332 335 344 385 389 397 398 399 436 439 455
459 469 478 485 489 544 547 623 624 629 633 645 654 722 723
725 726 727 729 740 741 744 765 773 774 834 838 874 877 885
886 962 963 964 965 966 968 987

Area Code 816

221 224 228 229 231 232 233 234 238 241 242 243 245 251 252
253 254 257 271 274 275 276 279 283 322 331 333 346 348 353

356 358 361 363 364 373 374 391 421 436 444 452 453 454 455
459 461 464 468 471 474 478 483 523 524 525 531 532 537 556
561 576 578 587 667 685 688 734 737 741 753 756 757 761 763
765 781 792 795 796 833 836 842 844 861 881 891 921 923 924
926 931 932 941 942 966 968 995 997

Area Code 817
232 236 237 244 246 249 261 265 267 268 273 274 275 277 280
281 282 283 284 292 293 294 295 297 322 325 328 332 334 335
336 338 346 355 356 379 382 383 387 390 429 430 431 439 441
443 444 447 448 451 452 456 457 460 461 465 467 469 473 477
478 481 483 485 488 489 491 493 496 498 499 523 524 525 528
529 531 534 535 536 538 540 541 544 551 560 565 566 569 571
572 574 577 586 588 589 592 594 595 599 624 625 626 633 640
649 654 656 662 666 679 682 691 692 696 723 731 732 735 737
738 752 753 754 755 756 757 761 763 766 767 771 772 773 774
776 777 778 780 787 788 792 794 795 799 822 826 829 831 834
836 838 840 844 848 851 853 855 857 859 860 863 870 875 876
877 881 921 923 924 926 927 930 938 939 982 983 984 985 986

Area Code 818 ****Entire Area Code Is Served****

Area Code 901
272 274 276 278 320 323 324 327 332 345 346 348 353 357 358
362 363 365 369 372 377 382 386 388 396 398 452 454 458 521
522 523 524 525 526 527 528 529 535 577 578 682 683 685 721
722 725 726 728 729 743 744 745 754 755 756 761 762 765 766
767 774 775 785 789 794 795 797 829 853 867 872 873 876 922
942 946 947 948

Area Code 904
241 246 249 251 262 264 266 268 269 272 282 285 289 350 353
354 355 356 358 359 384 387 388 389 390 393 396 398 399 432
433 434 436 438 452 453 455 456 474 476 477 478 492 632 633
634 636 641 642 646 721 723 724 725 731 733 737 739 743 744
751 757 764 765 766 768 771 772 777 778 781 783 786 791 798
932 944 968 994

Area Code 912
431 432 435 436 439 474 477 734 741 742 743 744 745 746 759
776 781 784 787 788 792 883 888 922 923 926 929 932 935 953
956 986

Area Code 913
232 233 234 235 236 262 266 267 268 272 273 281 286 287 288
289 295 296 299 321 334 341 342 354 357 362 365 371 375 379
381 383 384 422 432 441 478 492 541 564 573 574 576 582 588
596 621 631 642 648 649 661 663 671 676 677 681 685 721 722
724 761 764 775 782 788 791 829 831 862 887 888 894 897 967

Area Code 914
235 237 251 253 273 278 279 285 321 328 332 335 337 345 347
354 362 375 381 390 391 423 428 472 476 478 576 591 592 631
632 633 636 642 664 667 668 681 682 683 684 686 693 694 696
697 698 699 723 725 738 747 761 764 765 769 776 779 789 793
833 834 835 890 899 934 937 939 946 948 949 961 963 964 965
967 968 969 976 997

Area Code 915

332	333	334	335	337	362	366	367	368	381	385	465	468	469	529
532	533	537	541	542	543	544	545	546	548	561	562	563	564	565
566	568	569	581	584	591	592	593	594	598	653	655	657	658	672
673	675	676	677	682	683	684	685	686	687	688	689	691	692	694
695	696	697	698	699	747	751	755	757	772	775	778	779	821	833
851	852	855	858	859	860	877	886	942	944	949				

Area Code 916

322	323	324	325	328	329	331	332	334	338	344	351	355	361	362
363	364	366	369	371	372	381	383	386	388	391	392	393	395	421
422	423	424	427	428	440	441	442	443	444	445	446	447	448	449
451	452	453	454	455	456	457	481	482	483	484	485	486	487	488
489	635	636	638	641	643	648	665	682	685	687	689	722	723	725
726	728	731	736	739	766	771	781	782	783	786	791	797	920	921
922	924	925	927	929	933	944	961	962	965	966	967	969	971	972
973	985	988	989	991										

Area Code 918

224	227	234	241	245	250	251	252	254	258	266	272	288	299	366
369	425	428	437	438	445	446	451	455	460	477	481	492	493	494
495	496	560	561	581	582	583	584	585	586	587	588	592	599	622
627	628	660	663	664	665	742	743	744	745	747	749	831	832	834
835	836	838												

Area Code 919

248	266	269	271	272	273	274	275	279	282	286	288	292	294	299
362	365	370	373	375	377	378	379	383	429	431	434	454	467	469
471	472	475	476	477	489	493	528	541	543	544	549	552	553	556
575	595	596	598	621	622	639	643	656	668	674	680	681	682	683
684	685	688	697	698	721	722	723	724	725	727	730	733	737	744
748	750	755	760	761	764	765	766	767	768	769	770	772	773	777
779	781	782	784	785	787	788	321	828	829	832	833	834	836	839
847	848	851	852	854	855	859	860	869	872	876	878	882	883	884
885	886	887	888	889	890	922	924	945	969	983	993	994	996	998

APPENDIX E
AT&T, MCI, AND GTE SPRINT TARIFF RATES

Tariff rates for AT&T MTS (current and proposed), MCI Execunet, and GTE Sprint's SPRINT appear first in this appendix followed by the tariff rates for AT&T WATS (current and proposed), MCI WATS, and Direct Sprint. Methods of applying the tariffs are described below.

AT&T MTS, MCI Execunet, and SPRINT

AT&T MTS and SPRINT charges are based on a rate for the first minute plus a rate for additional minutes in each rate period, while MCI Execunet has a single rate for all minutes in a rate period. All of these services round up the duration of the call to the next higher minute--they bill in one minute increments. AT&T MTS costs are calculated at the day rate, regardless of rate period, then discounted according to the rate period in which the call was made. (The discounts are 40 percent for the Evening rate period and 60 percent for the Night and Weekend rate period. A 55 percent discount is applied to calls to Alaska and Hawaii during the Night and Weekend rate period under the current tariff.) SPRINT service is discounted based upon total dollar amount of the bill. (See the SPRINT rate table below.) MCI Execunet has separate rates for calls to network and non-network cities. Tenths of a cent are truncated from the costs calculated for each AT&T MTS call and are rounded for each MCI Execunet and SPRINT call.

AT&T WATS, MCI WATS, and Direct Sprint

AT&T WATS measures the duration of a call in one second increments, MCI WATS uses thirty second increments, and Direct Sprint uses six second increments. All three of

these services have a one minute minimum average time requirement. Also, all three have the same points at which the rates taper; 15, 40, and 80 hours (or equivalent minutes). Costs are calculated based on average use per line per rate period. In other words, the total usage in each rate period for all lines (WATS lines or DALs) is divided by the number of lines to obtain an average use per line per rate period. (AT&T WATS rounds this average to the nearest tenth of an hour.) MCI WATS and Direct Sprint also calculate the average for calls to network and non-network cities. (See rate tables below.) The average use per line per rate period and the per line monthly recurring charges are used to calculate the cost per line. The cost per line is multiplied by the total number of lines to obtain the total cost. An example follows:

Two AT&T WATS lines (Service Area 6) are used as follows during a one month period:

Rate Period	Hours
Business Day	100
Evening	40.45
Night and Weekend	10

The average use per line per rate period is:

Rate Period	Hours
Business Day	100 / 2 = 50
Evening	40.45 / 2 = 20.225 (rounded to the nearest tenth of an hour = 20.2)
Night and Weekend	10 / 2 = 5

The cost per line per rate period (assuming rate step 20 for Service Area 6 calling from California for AT&T WATS (current rates)) is:

Business Day Rate Period (50 hours total per line average)

15 hours X $25.82	= $387.30
25 hours X $22.98	= $574.50
10 hours X $21.03	= $210.30
Total	$1172.10

Evening Rate Period (20.2 hours total per line average)

15	hours	X $16.78	= $251.70
5.2	hours	X $14.94	= $ 77.69
		Total	$329.39

Night and Weekend Rate Period (5 hours total per line average)

5 hours X 9.04 = $ 45.20

Total cost per line:

Business Day Rate Period	$1172.10
Evening Rate Period	$ 329.39
Night and Weekend Rate Period	$ 45.20
Per line Monthly Recurring Charges	$ 31.65
Total Cost per line	$1578.34

Total cost:

$1578.34 per line X 2 lines = $3156.68

The process is the same for MCI WATS and Direct Sprint except the average use per line per rate period is not rounded.

AT&T MTS (Current Tarriff Rates)

Intra-Mainland

Per Minute Charges

Miles	Day		Evening (40% discount)		Night and Weekend (60% discount)	
	1st min	Add. min	1st min	Add. min	1st min	Add. min
	------Approximations------					
1-10	.32	.16	.192	.096	.128	.064
11-22	.40	.22	.240	.132	.160	.088
23-55	.48	.28	.288	.168	.192	.112
56-124	.57	.37	.342	.222	.228	.148
125-292	.58	.39	.348	.234	.232	.156
293-430	.59	.42	.354	.252	.236	.168
431-925	.62	.43	.372	.258	.248	.172
926-1910	.64	.44	.384	.264	.256	.176
1911-3000	.74	.49	.444	.294	.296	.196
3001-4250	.76	.51	.456	.306	.304	.204
4251-5750	.79	.53	.474	.318	.316	.212

American Telephone and Telegraph Co. Tariff FCC No. 263, p 19, 1 Feb 1984.

AT&T MTS (Current Tariff Rates) (Continued)

Mainland-Alaska

Per Minute Charges

-------Approximations--------

Miles	Day		Evening (40% discount)		Night and Weekend (55% discount)	
	1st min	Add. min	1st min	Add. min	1st min	Add. min
431-925	.62	.43	.372	.258	.279	.194
926-1910	.64	.46	.384	.276	.288	.207
1911-3000	.74	.54	.444	.324	.333	.243
3001-4250	.79	.62	.474	.372	.356	.279
4251-5750	.87	.70	.522	.420	.392	.315

American Telephone and Telegraph Co. Tariff FCC No. 263, p 20.1, 1 Feb 1984.

AT&T MTS (Current Tariff Rates) (Continued)

Mainland-Hawaii

Per Minute Charges

Band	Day		Evening (40% discount)		Night and Weekend (55% discount)	
	1st min	Add. min	1st min	Add. min	1st min	Add. min
	------- Approximations -------					
1*	.74	.49	.444	.294	.333	.221
2**	.76	.53	.456	.306	.342	.239
3***	.79	.55	.474	.318	.356	.248

*Band 1: Arizona, California, Idaho, Nevada, Oregon, Utah, and Washington.

**Band 2: Arkansas, Colorado, Illinois, Iowa, Kansas, Louisiana, Minnesota, Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Wisconsin, and Wyoming.

***Band 3: Alabama, Connecticut, Delaware, District of Columbia, Florida, Georgia, Indiana, Kentucky, Maine, Maryland, Massachussetts, Michigan, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, and West Virginia.

American Telephone and Telegraph Co. Tariff FCC No. 263, p 20.2, 1 Feb 1984.

AT&T MTS (Proposed Tariff Rates)

Intra-Mainland and Mainland-Alaska

Per Minute Charges

-------Approximations--------

Miles	Day		Evening (40% discount)		Night and Weekend (60% discount)	
	1st min	Add. min	1st min	Add. min	1st min	Add. min
1-10	.31	.16	.186	.096	.124	.064
11-22	.39	.22	.234	.132	.156	.088
23-55	.47	.28	.282	.168	.188	.112
56-124	.56	.32	.336	.192	.224	.128
125-292	.57	.34	.342	.204	.228	.136
293-430	.58	.35	.348	.210	.232	.140
431-925	.61	.35	.366	.210	.244	.140
926-1910	.63	.38	.378	.228	.252	.152
1911-3000	.73	.43	.438	.258	.292	.172
3001-4250	.75	.45	.450	.270	.300	.180
4251-5750	.78	.47	.468	.282	.312	.188

AT&T Communications Tariff FCC No. 1, p 56, Issued 3 Oct 1983 to be effective 1 Jan 1984, but postponed indefinitely.

AT&T MTS (Proposed Tariff Rates) (Continued)

Mainland-Hawaii

Per Minute Charges

Band	Day		Evening (40% discount)		Night and Weekend (60% discount)	
	1st min	Add. min	1st min	Add. min	1st min	Add. min
			-------Approximations--------			
1*	.73	.43	.438	.258	.292	.172
2**	.75	.45	.450	.270	.300	.180
3***	.78	.47	.468	.282	.312	.188

*Band 1: Arizona, California, Idaho, Nevada, Oregon, Utah, and Washington.

**Band 2: Arkansas, Colorado, Illinois, Iowa, Kansas, Louisiana, Minnesota, Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Wisconsin, and Wyoming.

***Band 3: Alabama, Connecticut, Delaware, District of Columbia, Florida, Georgia, Indiana, Kentucky, Maine, Maryland, Massachussetts, Michigan, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, and West Virginia.

AT&T Communications Tariff FCC No. 1, p 59, Issued 3 Oct 1983 to be effective 1 Jan 1984, but postponed indefinitely.

MCI Execunet

Tier 1 (To Network Cities)

Per Minute Charges

Miles	Day	Evening	Night and Weekend
1-10	.1536	.0922	.0614
11-22	.2100	.1260	.0840
23-55	.2700	.1319	.1080
56-70	.3280	.1463	.1137
71-124	.3280	.1536	.1194
125-292	.3424	.1614	.1255
293-430	.3632	.1728	.1344
431-925	.3744	.1774	.1379
926-1910	.3840	.1816	.1412
1911-3000	.4320	.2029	.1579

Tier 2 (To Non-network Cities)

1-10	.1536	.0922	.0614
11-22	.2100	.1260	.0840
23-55	.2700	.1620	.1080
56-70	.3600	.2160	.1440
71-124	.3600	.2160	.1440
125-292	.3800	.2280	.1520
293-430	.4100	.2460	.1640
431-925	.4200	.2520	.1680
926-1910	.4300	.2580	.1720
1911-3000	.4800	.2880	.1920

MCI Telecommunications Corporation Tariff FCC No. 1, p 19 , 1 Apr 1983.

SPRINT

Per Minute Charges

Miles	Day		Evening		Night and Weekend	
	1st min	Add. min	1st min	Add. min	1st min	Add. min
1-10	.22	.155	.13	.0922	.06	.0599
11-22	.29	.216	.17	.1260	.08	.0799
23-55	.36	.276	.20	.1490	.14	.1080
56-70	.44	.336	.27	.1998	.18	.1299
71-124	.44	.336	.27	.1998	.18	.1299
125-292	.46	.352	.29	.2150	.19	.1440
293-430	.48	.369	.31	.2240	.20	.1530
431-925	.52	.382	.32	.2330	.21	.1550
926-1910	.53	.392	.33	.2390	.22	.1580
1911-3000	.61	.444	.35	.2592	.24	.1728
3001-4250	.63	.464	.36	.2804	.25	.1869
4251-5750	.65	.484	.38	.2910	.26	.1940

For Calls Originating from Hawaii

1911-3000	.41	.410	.2649	.2649	.1766	.1766
3001-4250	.44	.440	.2843	.2843	.1895	.1895
4251-5750	.47	.470	.2974	.2974	.1983	.1983

Usage Discounts

	Total Usage		
Rate Pericd	$25-$74.99	$75-$199.99	$200 and Over
Day	2%	5%	8%
Evening	7%	8%	10%
Night and Weekend	8%	10%	12%

GTE Sprint Communications Corporation Tariff FCC No. 11, p 34, 5 Jan 1984.

SPRINT (Continued)

Approximations For Over $200 Usage per Month

Per Minute Charges

Miles	Day		Evening		Night and Weekend	
	1st min	Add. min	1st min	Add. min	1st min	Add. min
1-10	.2024	.1426	.1170	.0830	.0528	.0527
11-22	.2668	.1987	.1530	.1134	.0704	.0703
23-55	.3312	.2539	.1800	.1341	.1232	.0950
56-70	.4048	.3091	.2430	.1798	.1584	.1143
71-124	.4048	.3091	.2430	.1798	.1584	.1143
125-292	.4232	.3238	.2610	.1935	.1672	.1267
293-430	.4416	.3395	.2790	.2016	.1760	.1346
431-925	.4784	.3514	.2880	.2097	.1848	.1364
926-1910	.4876	.3606	.2970	.2151	.1936	.1390
1911-3000	.5612	.4085	.3150	.2333	.2112	.1521
3001-4250	.5796	.4269	.3240	.2524	.2200	.1645
4251-5750	.5980	.4453	.3420	.2619	.2288	.1707

For Calls Originating from Hawaii

1911-3000	.3772	.3772	.2384	.2384	.1554	.1554
3001-4250	.4048	.4048	.2559	.2559	.1668	.1668
4251-5750	.4324	.4324	.2677	.2677	.1745	.1745

GTE Sprint Communications Corporation Tariff FCC No. 11, p 38, 5 Jan 1984.

AT&T WATS (Current Tariff Rates) (Service Areas 5 and 6)

Per Hour Charges

Rate Step	First 15 Hours Day	First 15 Hours Eve.	Next 25 Hours Day	Next 25 Hours Eve.	Next 40 Hours Day	Next 40 Hours Eve.	Over 80 Hours Day	Over 80 Hours Eve.	All Hours Night and Weekend
14	21.73	14.13	19.34	12.58	16.96	11.02	14.34	9.33	7.55
15	21.95	14.27	19.56	12.71	17.13	11.15	14.49	9.42	7.63
16	22.21	14.44	19.77	12.85	17.32	11.26	14.66	9.53	7.71
17	22.46	14.59	19.99	13.00	17.52	11.39	14.82	9.64	7.80
18	22.90	14.89	20.37	13.24	17.86	11.61	15.10	9.82	7.96
19	23.96	15.57	21.32	13.86	18.69	12.15	15.81	10.28	8.39
20	25.82	16.78	22.98	14.94	20.14	13.09	17.04	11.08	9.04
21	26.96	17.52	23.99	15.59	21.03	13.67	17.79	11.56	9.44
22	29.04	18.88	25.85	16.80	22.65	14.72	19.17	12.46	10.16
	(Per Minute Approximations For Rate Step 20)								
	.4303	.2797	.3830	.2490	.3357	.2182	.2840	.1847	.1507

Rate Step Table

[In the form: State(Rate step for Service Area 5, Rate Step for Service Area 6)]

Alabama(17,22), Arizona(18,20), Arkansas(15,21), California(18,20), Colorado(16,21), Connecticut(18,22), Delaware(18,22), District of Columbia(18,22), Florida(18,22), Georgia(18,22), Idaho(18,19), Illinois(15,21), Indiana(16,21), Iowa(14,21), Kansas(14,21), Kentucky(17,22), Louisiana(16,21), Maine(18,22), Maryland(18,22), Massachusetts(18,22), Michigan(17,21), Minnesota(15,21), Mississippi(16,22), Missouri(15,21), Montana(17,20), Nebraska(14,21), Nevada(18,20), New Hampshire(18,22), New Jersey(18,22), New Mexico(17,21), New York(18,22), North Carolina(18,22), North Dakota(15,21), Ohio(17,22), Oklahoma(15,21), Oregon(18,19), Pennsylvania(18,22), Rhode Island(18,22), South Carolina(18,22), South Dakota(15,21), Tennessee(17,22), Texas(16,21), Utah(18,20), Vermont(18,22), Virginia(18,22), Washington(18,19), West Virginia(18,22), Wisconsin(16,21), Wyoming(16,21)

Based on average use per line per rate period and rounded to the nearest tenth of an hour .

American Telephone and Telegraph Co. Tariff FCC No. 259, pp 13-14.1, 1 Jan 1984.

AT&T WATS (Proposed Tariff Rates) (Service Areas 5 and 6)*

Per Hour Charges

Rate Step	First 15 Hours Day	First 15 Hours Eve.	Next 25 Hours Day	Next 25 Hours Eve.	Next 40 Hours Day	Next 40 Hours Eve.	Over 80 Hours Day	Over 80 Hours Eve.	All Hours Night and Weekend
14	19.40	12.62	17.27	11.23	15.15	9.84	12.81	8.33	6.74
15	19.60	12.74	17.47	11.35	15.30	9.96	12.94	8.41	6.81
16	19.83	12.89	17.65	11.48	15.47	10.06	13.09	8.51	6.89
17	20.06	13.03	17.85	11.61	15.65	10.17	13.23	8.61	6.97
18	20.45	13.30	18.19	11.82	15.95	10.37	13.48	8.77	7.11
	(Per Minute Approximations For Rate Step 18)								
	.3408	.2217	.3032	.1970	.2658	.1728	.2247	.1462	.1185

Rate Step 14 - Iowa, Kansas, Nebraska

Rate Step 15 - Arkansas, Illinois, Minnesota, Missouri, North Dakota, Oklahoma, South Dakota

Rate Step 16 - Colorado, Indiana, Louisiana, Mississippi, Texas, Wisconsin, Wyoming

Rate Step 17 - Alabama, Kentucky, Michigan, Montana, New Mexico, Ohio, Tennessee

Rate Step 18 - Arizona, California, Connecticut, Delaware, District of Columbia, Florida, Georgia, Idaho, Maine, Maryland, Massachussetts, Nevada, New Hampshire, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, South Carolina, Utah, Vermont, Virginia, Washington, West Virginia

*Service areas 5 and 6 have the same rates.

Based on average use per line per rate period and rounded to the nearest tenth of an hour .

AT&T Communications Tariff FCC No. 2, pp 74-75, Issued 3 Oct 1983 to be effective 1 Jan 1984, but postponed indefinitely.

MCI Network Service with Universal Termination (MCI WATS) *

Tier 1 (To Network Cities)

Per Minute Charges

0-900 min (First 15 Hours)		900.5-2400 min (Next 25 Hours)		2400.5-4800 min (Next 40 Hours)		Over 4800 min (Over 80 Hours)		All minutes *********
Day	Evening	Day	Evening	Day	Evening	Day	Evening	Night and Weekend
.2721	.1767	.2420	.1572	.2120	.1378	.1795	.1166	.1000

Tier 2 (To Non-network Cities)

All minutes

Day	Evening	Night and Weekend
.340	.248	.152

*MCI Network Service (without Universal Termination) is billed at Tier 1 Rates.

Based on average use per line per rate period.

MCI Telecommunications Corporation Tariff FCC No. 1, pp 19.6-19.7, 1 Apr 1983.

Direct Sprint

To Network Cities

Per Minute Charges

0-900 min (First 15 Hours)		901-2400 min (Next 25 Hours)		2401-4800 min (Next 40 Hours)		Over 4800 min (Over 80 Hours)		All minutes ********* Night and Weekend
Day	Evening	Day	Evening	Day	Evening	Day	Evening	
.257	.187	.257	.165	.222	.145	.194	.123	.108

Based on average use per line per rate period.

GTE Sprint Communications Corporation Tariff FCC No. 10, p 42, 5 Jan 1984.

Direct Sprint (Continued)

To Non-Network Cities*

Per Minute Charges

0-900 min (First 15 Hours)		901-2400 min (Next 25 Hours)		2401-4800 min (Next 40 Hours)		Over 4800 min (Over 80 Hours)		All minutes *********
Day	Evening	Day	Evening	Day	Evening	Day	Evening	Night and Weekend
.3658	.2378	.3260	.2118	.2855	.1858	.2415	.1570	.1271

*Applicable to calls originated from:

Atlanta, GA	Denver, CO
Chicago, IL	Detroit, MI
Cincinnati, OH	Houston, TX
Cleveland, OH	Milwaukee, WI
Dallas, TX	New Orleans, LA

Based on average use per line per rate period.

GTE Sprint Communications Corporation Tariff FCC No. 10, p 42, 5 Jan 1984.

Direct Sprint (Continued)

To Non-Network Cities**

Per Minute Charges

0-900 min (First 15 Hours)		901-2400 min (Next 25 Hours)		2401-4800 min (Next 40 Hours)		Over 4800 min (Over 80 Hours)		All minutes *********
Day	Evening	Day	Evening	Day	Evening	Day	Evening	Night and Weekend
.3816	.2481	.3395	.2206	.2976	.1935	.2516	.1636	.1326

**Applicable to calls originated from:

Baltimore, MD	Philadelphia, PA
Boston, MA	Phoenix, AZ
Buffalo, NY	Rochester, NY
Charlotte, NC	San Francisco, CA
Los Angeles, CA	San Jose, CA
Miami, FL	Seattle, WA
New York, NY	Washington, DC
Orangeville, NY	

Based on average use per line per rate period.

GTE Sprint Communications Corporation Tariff FCC No. 10, p 43, 5 Jan 1984.

Direct Sprint (Continued)

Calls To Alaska and To and From Hawaii (except Honolulu)

Per Minute Charges

Miles	0-900 min (First 15 Hours) Day	0-900 min (First 15 Hours) Evening	901-2400 min (Next 25 Hours) Day	901-2400 min (Next 25 Hours) Evening	2401-4800 min (Next 40 Hours) Day	2401-4800 min (Next 40 Hours) Evening	Over 4800 min (Over 80 Hours) Day	Over 4800 min (Over 80 Hours) Evening
431-925	.3993	.2595	.3553	.2310	.3115	.2025	.2635	.1713
926-3000	.4303	.2797	.3830	.2490	.3357	.2182	.2840	.1847
3001-4250	.4493	.2920	.3998	.2598	.3505	.2278	.2965	.1927
4251-5750	.4840	.3147	.4308	.2800	.3775	.2453	.3195	.2077

Miles	All minutes Night and Weekend
431-925	.1398
926-3000	.1507
3001-4250	.1573
4251-5750	.1693

Based on average use per line per rate period.

GTE Sprint Communications Corporation Tariff FCC No. 10, pp 43-44, 5 Jan 1984.

APPENDIX F

ERLANG B TABLES

Erlangs	Grade of Service	No. of Trunks
0.20	0.167	1
0.20	0.016	2
0.20	0.001	3
0.40	0.286	1
0.40	0.054	2
0.40	0.007	3
0.60	0.375	1
0.60	0.101	2
0.60	0.020	3
0.60	0.003	4
0.80	0.444	1
0.80	0.151	2
0.80	0.039	3
0.80	0.008	4
0.80	0.001	5
1.00	0.500	1
1.00	0.200	2
1.00	0.063	3
1.00	0.015	4
1.00	0.003	5
1.20	0.545	1
1.20	0.247	2
1.20	0.090	3
1.20	0.026	4
1.20	0.006	5
1.20	0.001	6
1.40	0.583	1
1.40	0.290	2
1.40	0.119	3
1.40	0.040	4
1.40	0.011	5
1.40	0.003	6
1.60	0.330	2
1.60	0.150	3
1.60	0.056	4
1.60	0.018	5
1.60	0.005	6
1.60	0.001	7
1.80	0.367	2
1.80	0.180	3
1.80	0.075	4
1.80	0.026	5
1.80	0.008	6
1.80	0.002	7
2.00	0.400	2
2.00	0.211	3
2.00	0.095	4
2.00	0.037	5
2.00	0.012	6
2.00	0.003	7
2.20	0.431	2
2.20	0.240	3
2.20	0.117	4
2.20	0.049	5
2.20	0.018	6
2.20	0.005	7
2.20	0.002	8
2.40	0.459	2
2.40	0.268	3
2.40	0.139	4
2.40	0.062	5
2.40	0.024	6
2.40	0.008	7
2.40	0.002	8
2.60	0.484	2
2.60	0.296	3
2.60	0.161	4
2.60	0.077	5
2.60	0.032	6
2.60	0.012	7
2.60	0.004	8
2.60	0.001	9
2.80	0.508	2
2.80	0.322	3
2.80	0.184	4
2.80	0.093	5
2.80	0.042	6
2.80	0.016	7
2.80	0.006	8
2.80	0.002	9
3.00	0.529	2
3.00	0.346	3
3.00	0.206	4
3.00	0.110	5
3.00	0.052	6
3.00	0.022	7
3.00	0.008	8
3.00	0.003	9

Erlangs	Grade of Service	No. of Trunks
3.20	0.549	2
3.20	0.369	3
3.20	0.228	4
3.20	0.127	5
3.20	0.064	6
3.20	0.028	7
3.20	0.011	8
3.20	0.004	9
3.20	0.001	10
3.40	0.568	2
3.40	0.392	3
3.40	0.250	4
3.40	0.145	5
3.40	0.076	6
3.40	0.036	7
3.40	0.015	8
3.40	0.006	9
3.40	0.002	10
3.60	0.585	2
3.60	0.412	3
3.60	0.271	4
3.60	0.163	5
3.60	0.089	6
3.60	0.044	7
3.60	0.019	8
3.60	0.008	9
3.60	0.003	10
3.80	0.432	3
3.80	0.291	4
3.80	0.181	5
3.80	0.103	6
3.80	0.053	7
3.80	0.025	8
3.80	0.010	9
3.80	0.004	10
3.80	0.001	11
4.00	0.451	3
4.00	0.311	4
4.00	0.199	5
4.00	0.117	6
4.00	0.063	7
4.00	0.030	8
4.00	0.013	9
4.00	0.005	10
4.00	0.002	11
4.50	0.493	3
4.50	0.357	4
4.50	0.243	5
4.50	0.154	6
4.50	0.090	7
4.50	0.048	8
4.50	0.024	9
4.50	0.010	10
4.50	0.004	11
4.50	0.002	12
5.00	0.530	3
5.00	0.398	4
5.00	0.285	5
5.00	0.192	6
5.00	0.121	7
5.00	0.070	8
5.00	0.037	9
5.00	0.018	10
5.00	0.008	11
5.00	0.003	12
5.00	0.001	13
5.50	0.562	3
5.50	0.436	4
5.50	0.324	5
5.50	0.229	6
5.50	0.153	7
5.50	0.095	8
5.50	0.055	9
5.50	0.029	10
5.50	0.014	11
5.50	0.007	12
5.50	0.003	13
5.50	0.001	14
6.00	0.590	3
6.00	0.470	4
6.00	0.360	5
6.00	0.265	6
6.00	0.185	7
6.00	0.122	8
6.00	0.075	9
6.00	0.043	10
6.00	0.023	11
6.00	0.011	12
6.00	0.005	13
6.00	0.002	14
6.50	0.500	4
6.50	0.394	5
6.50	0.299	6
6.50	0.217	7
6.50	0.150	8
6.50	0.098	9
6.50	0.060	10
6.50	0.034	11
6.50	0.018	12
6.50	0.009	13
6.50	0.004	14
6.50	0.002	15
7.00	0.527	4
7.00	0.425	5
7.00	0.331	6
7.00	0.249	7
7.00	0.179	8
7.00	0.122	9
7.00	0.079	10
7.00	0.048	11
7.00	0.027	12
7.00	0.014	13
7.00	0.007	14
7.00	0.003	15
7.00	0.001	16

Erlangs	Grade of Service	No. of Trunks
8.00	0.575	4
8.00	0.479	5
8.00	0.390	6
8.00	0.308	7
8.00	0.236	8
8.00	0.173	9
8.00	0.122	10
8.00	0.081	11
8.00	0.051	12
8.00	0.031	13
8.00	0.017	14
8.00	0.009	15
8.00	0.005	16
8.00	0.002	17
9.00	0.525	5
9.00	0.441	6
9.00	0.362	7
9.00	0.289	8
9.00	0.224	9
9.00	0.168	10
9.00	0.121	11
9.00	0.083	12
9.00	0.054	13
9.00	0.034	14
9.00	0.020	15
9.00	0.011	16
9.00	0.006	17
9.00	0.003	18
9.00	0.001	19
10.00	0.564	5
10.00	0.485	6
10.00	0.409	7
10.00	0.338	8
10.00	0.273	9
10.00	0.215	10
10.00	0.163	11
10.00	0.120	12
10.00	0.084	13
10.00	0.057	14
10.00	0.036	15
10.00	0.022	16
10.00	0.013	17
10.00	0.007	18
10.00	0.004	19
10.00	0.002	20
11.00	0.597	5
11.00	0.523	6
11.00	0.451	7
11.00	0.383	8
11.00	0.319	9
11.00	0.260	10
11.00	0.206	11
11.00	0.159	12
11.00	0.119	13
11.00	0.085	14
11.00	0.059	15
11.00	0.039	16
11.00	0.025	17
11.00	0.015	18
11.00	0.008	19
11.00	0.005	20
11.00	0.002	21
11.00	0.001	22
12.00	0.556	6
12.00	0.488	7
12.00	0.423	8
12.00	0.360	9
12.00	0.302	10
12.00	0.248	11
12.00	0.199	12
12.00	0.155	13
12.00	0.117	14
12.00	0.086	15
12.00	0.060	16
12.00	0.041	17
12.00	0.027	18
12.00	0.016	19
12.00	0.010	20
12.00	0.006	21
12.00	0.003	22
12.00	0.002	23
13.00	0.585	6
13.00	0.521	7
13.00	0.458	8
13.00	0.398	9
13.00	0.341	10
13.00	0.287	11
13.00	0.237	12
13.00	0.192	13
13.00	0.151	14
13.00	0.116	15
13.00	0.086	16
13.00	0.062	17
13.00	0.043	18
13.00	0.028	19
13.00	0.018	20
13.00	0.011	21
13.00	0.007	22
13.00	0.004	23
13.00	0.002	24
13.00	0.001	25
14.00	0.550	7
14.00	0.490	8
14.00	0.433	9
14.00	0.377	10
14.00	0.324	11
14.00	0.275	12
14.00	0.228	13
14.00	0.186	14
14.00	0.148	15
14.00	0.115	16
14.00	0.086	17
14.00	0.063	18
14.00	0.044	19
14.00	0.030	20
14.00	0.020	21
14.00	0.012	22
14.00	0.007	23
14.00	0.004	24
14.00	0.002	25
14.00	0.001	26

Erlangs	Grade of Service	No. of Trunks
15.00	0.576	7
15.00	0.519	8
15.00	0.464	9
15.00	0.410	10
15.00	0.359	11
15.00	0.310	12
15.00	0.263	13
15.00	0.220	14
15.00	0.180	15
15.00	0.145	16
15.00	0.113	17
15.00	0.086	18
15.00	0.064	19
15.00	0.046	20
15.00	0.032	21
15.00	0.021	22
15.00	0.014	23
15.00	0.008	24
15.00	0.005	25
15.00	0.003	26
15.00	0.002	27
16.00	0.599	7
16.00	0.545	8
16.00	0.492	9
16.00	0.441	10
16.00	0.391	11
16.00	0.342	12
16.00	0.296	13
16.00	0.253	14
16.00	0.213	15
16.00	0.175	16
16.00	0.142	17
16.00	0.112	18
16.00	0.086	19
16.00	0.064	20
16.00	0.047	21
16.00	0.033	22
16.00	0.022	23
16.00	0.015	24
16.00	0.009	25
16.00	0.006	26
16.00	0.003	27
16.00	0.002	28
16.00	0.001	29
17.00	0.569	8
17.00	0.518	9
17.00	0.468	10
17.00	0.420	11
17.00	0.373	12
17.00	0.328	13
17.00	0.285	14
17.00	0.244	15
17.00	0.206	16
17.00	0.171	17
17.00	0.139	18
17.00	0.110	19
17.00	0.086	20
17.00	0.065	21
17.00	0.048	22
17.00	0.034	23
17.00	0.024	24
17.00	0.016	25
17.00	0.010	26
17.00	0.006	27
17.00	0.004	28
17.00	0.002	29
17.00	0.001	30
18.00	0.590	8
18.00	0.541	9
18.00	0.493	10
18.00	0.447	11
18.00	0.401	12
18.00	0.357	13
18.00	0.315	14
18.00	0.274	15
18.00	0.236	16
18.00	0.200	17
18.00	0.166	18
18.00	0.136	19
18.00	0.109	20
18.00	0.086	21
18.00	0.065	22
18.00	0.049	23
18.00	0.035	24
18.00	0.025	25
18.00	0.017	26
18.00	0.011	27
18.00	0.007	28
18.00	0.004	29
18.00	0.003	30
18.00	0.002	31
19.00	0.563	9
19.00	0.517	10
19.00	0.472	11
19.00	0.427	12
19.00	0.385	13
19.00	0.343	14
19.00	0.303	15
19.00	0.264	16
19.00	0.228	17
19.00	0.194	18
19.00	0.163	19
19.00	0.134	20
19.00	0.108	21
19.00	0.085	22
19.00	0.066	23
19.00	0.050	24
19.00	0.036	25
19.00	0.026	26
19.00	0.018	27
19.00	0.012	28
19.00	0.008	29
19.00	0.005	30
19.00	0.003	31
19.00	0.002	32
19.00	0.001	33

Erlangs	Grade of Service	No. of Trunks
20.00	0.582	9
20.00	0.538	10
20.00	0.494	11
20.00	0.452	12
20.00	0.410	13
20.00	0.369	14
20.00	0.330	15
20.00	0.292	16
20.00	0.256	17
20.00	0.221	18
20.00	0.189	19
20.00	0.159	20
20.00	0.131	21
20.00	0.107	22
20.00	0.085	23
20.00	0.066	24
20.00	0.050	25
20.00	0.037	26
20.00	0.027	27
20.00	0.019	28
20.00	0.013	29
20.00	0.008	30
20.00	0.005	31
20.00	0.003	32
20.00	0.002	33
20.00	0.001	34

APPENDIX G

COMPUTER PROGRAM LISTING

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$JOB            ID,NOIIST,NARR,L=80
C*****************************************************************
C
C     THIS PROGRAM WAS CREATED BY SCOTT L. KLINGLER, CAPTAIN, USAF IN
C     MARCH 1984.  IT WAS WRITTEN FOR INTERACTIVE COMPUTING USING THE
C     WATFIV FACILITIES OF THE IBM 3033 AT THE NAVAL POSTGRADUATE
C     SCHOOL.  ADDITIONAL INFORMATION ABOUT THIS PROGRAM CAN BE
C     OBTAINED IN KLINGLER, SCOTT L., SPECIALIZED COMMON CARRIERS:
C     ICNG DISTANCE AITERNATIVES FOR MILITARY INSTALLATIONS, MASTER'S
C     THESIS, NAVAL POSTGRADUATE SCHOOL, MONTEREY, CA, MARCH 1984.
C
C*****************************************************************
C*****************************************************************
C
C     THIS PROGRAM PERFORMS THE FOLLOWING FUNCTIONS:
C
C        1.  PUTS AREA CODES AND PREFIXES OF SPECIALIZED COMMON
C            CARRIER (SCC) NETWORKS FROM FILES INTO AN ARRAY NUM
C
C        2.  COMPARES CALLED NUMBER (AREA CODE AND PREFIX) TO SCC
C            NETWORKS.  (NOTE: IF AREA CODE IS NOT ONE OF THOSE LISTED
C            IN DO 10 (ALL AREA CODES IN UNITED STATES) DATA FOR THE
C            CALLED NUMBER WILL BE REJECTED.)
C
C        3.  CALCULATES DISTANCE (RANGE OF DISTANCES) TO CALLED CITY FROM
C            THE DURATION, RATE PERIOD, AND ORIGINAL COST OF THE CALL.
C            (NOTE: IF DISTANCE WILL NOT CALCULATE (DUE TO INCORRECT
C            DATA, MULTIPLE RATE PERIOD, DISTANCES FURTHER THAN LONGEST
C            RANGE OF DISTANCES ALLOWED IN PROGRAM, ETC.) CALL DATA WILL
C            BE REJECTED.)
C
C        4.  CALCULATES CHARGES FOR MTS-TYPE CALLS (DIAL ACCESS SERVICE
C            - AT&T MTS, MCI EXECUNET, AND SPRINT) BASED ON DURATION OF
C            CALL, RATE PERIOD, AND MILEAGE AND TOTALS MINUTES OF CALLS
C            IN EACH RATE PERIOD TO NETWORK AND NON-NETWORK CITIES.
C
C        5.  CALCULATES CHARGES FOR WATS-TYPE CALLS (DEDICATED ACCESS
C            SERVICE - AT&T WATS, MCI WATS (NETWORK SERVICE WITH UNIVERSAL
C            TERMINATION), AND DIRECT SPRINT) BASED ON THE AVERAGE TIME
C            PER ACCESS LINE PER RATE PERIOD.
C
C*****************************************************************
C
C     ASSUMPTIONS AND LIMITATIONS
C
C    *  THIS PROGRAM CAN BE USED ONLY FOR CALCULATING COSTS OF CALLS (VIA
C    AT&T MTS AND WATS, MCI EXECUNET AND MCI WATS, AND SPRINT AND DIRECT
C    SPRINT WITH UNIVERSAL CALLING) ORIGINATED WITHIN THE CONTINENTAL
C    UNITED STATES (CONUS) AND COMPLETED TO CONUS, HAWAII, AND ALASKA.
C    IT ALSO ASSUMES THAT THE USER KNOWS IF THE LOCATION BEING EVALUATED
C    IS IN AN AREA WHICH PERMITS ORIGINATING CALLS VIA THESE SERVICES.
C
C    *  TELEPHONE BILL DATA FROM A ONE MONTH PERIOD IS USED FOR THE
C    INPUT DATA.  (THE USER SHOULD CONSIDER USING AN AVERAGE MONTH'S
C    BILL AND A PEAK MONTH'S BILL TO EVALUATE THE COSTS AND NUMBER OF
C    WATS AND DEDICATED ACCESS LINES (DALS) FOR AVERAGE AND PEAK MONTHS
C    OF TELEPHONE USAGE IN ORDER TO DETERMINE IF THERE IS A SIGNIFICANT
C    DIFFERENCE.)
C
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C     * TENTHS OF A CENT ARE TRUNCATED FROM THE COSTS CALCULATED FOR EACH
C     AT&T MTS CALL AND ROUNDED FOR EACH MCI EXECUNET AND SPRINT CALL.
C
C     * SINCE CALLS TO HAWAII MADE VIA AT&T MTS ARE BILLED BY BAND AND
C     NOT BY MILEAGE, THE PROGRAM CONVERTS BANDS TO MILEAGE RANGES FOR
C     USE IN CALCULATING THE COSTS VIA THE OTHER CARRIERS.  THE CORRECT-
C     NESS OF THESE CONVERSIONS HAS NOT BEEN DETERMINED EXCEPT FOR THE
C     WEST COAST.
C
C     * COSTS FOR CALLS MADE VIA DIAL ACCESS SERVICES (MCI EXECUNET AND
C     SPRINT) IN THE 56-70 AND 71-124 MILE DISTANCE RANGES ARE CALCULATED
C     USING THE RATES FOR THE 71-124 MILE RANGE SINCE AT&T MTS HAS ONLY A
C     56-124 MILE RANGE (AND THE DISTANCE (RANGE OF DISTANCES) TO THE
C     CALLED NUMBER IS CALCULATED FROM THE DURATION, RATE PERIOD, AND COST
C     OF THE ORIGINAL AT&T MTS CALL.)
C
C     * COSTS FOR CALLS MADE VIA MCI EXECUNET OVER 3000 MILES ARE
C     CALCULATED USING THE RATES FOR THE 1911-3000 MILE RANGE SINCE
C     THERE IS NO RATE SHOWN IN THE TARIFF FOR DISTANCES GREATER THAN
C     3000 MILES.
C
C     * COSTS FOR CALLS MADE VIA SPRINT ARE CALCULATED USING THE RATES
C     WHICH ARE DISCOUNTED FOR OVER $200 USAGE PER MONTH.
C
C     * THE PROGRAM CALCULATES THE COSTS OF ACCESSING THE DIAL ACCESS
C     SERVICES, IF ANY, USING FIRST MINUTE AND ADDITIONAL MINUTE RATES,
C     THE RATE PERIODS IN THE TABLE IN SUBROUTINE QUERY, AND ONLY THE
C     DURATION OF THE COMPLETED LONG DISTANCE CALL.
C
C     * SINCE ORIGINAL CALL DATA IS IN ONE MINUTE INCREMENTS, WATS AND
C     DEDICATED ACCESS SERVICE COST CALCULATIONS DO NOT CONSIDER THE
C     LESS THAN ONE MINUTE INCREMENTS USED BY THESE CARRIERS OR THE ONE
C     MINUTE MINIMUM AVERAGE TIME REQUIREMENT OF THESE CARRIERS.
C
C     * WATS AND DEDICATED ACCESS SERVICE COST CALCULATIONS INCLUDE THE
C     MONTHLY RECURRING CHARGES PER ACCESS LINE BUT NOT ORDER OR INSTALLA-
C     TION CHARGES.  THE MONTHLY RECURRING CHARGES USED IN THE PROGRAM
C     ARE THE BASIC CHARGES WHICH ASSUME THAT THE INSTALLATION IS CLOSE
C     ENOUGH TO THE CARRIER'S POINT OF TERMINATION SO AS TO AVOID
C     ADDITIONAL MILEAGE CHARGES.
C
C     * COSTS FOR AT&T WATS (CURRENT TARIFF) ARE CALCULATED USING SERVICE
C     AREA 6 RATES.  THE RATES USED FOR CALCULATING COSTS OF AT&T WATS
C     (PROPOSED TARIFF) ARE FOR SERVICE AREAS 5 AND 6 (WHICH HAVE THE SAME
C     RATES).
C
C     * THE PROGRAM DOES NOT ROUND THE TOTAL HOURS OF CALLS IN EACH RATE
C     PERIOD TO THE NEAREST TENTH OF AN HOUR FOR AT&T WATS COST
C     CALCULATIONS.
C
C     * COSTS ARE CALCULATED FOR DEDICATED ACCESS SERVICES WITH
C     "UNIVERSAL TERMINATION" (MCI WATS AND DIRECT SPRINT WITH UNIVERSAL
C     CALLING), AND NOT FOR NETWORK-ONLY TERMINATION SERVICE.
C
C*****************************************************************
C
C      THE FOLLOWING EXEC FILE WAS USED TO EXECUTE THE PROGRAM
C
C
C    &TRACE OFF
C    FILEDEF 8 DISK MCI DATA A (RECFM F LRECL 80 BLKSIZE 80
C    FILEDEF 9 DISK SPRINT DATA A (RECFM F LRECL 80 BLKSIZE 80
C    FILEDEF 10 DISK TOLL DATA A (RECFM F LRECL 80 BLKSIZE 80
C    FILEDEF 11 DISK DATAOUT DATA A (RECFM F LRECL 80 BLKSIZE 80
C    FILEDEF 12 DISK REJECT DATA A (RECFM F LRECL 80 BLKSIZE 80
C    FILEDEF 13 TERM (RECFM F LRECL 80 BLKSIZE 80
C    EXEC WATFIV SCCPROJ &1
C    CIRSCRN
C    &TYPE DO YOU WANT TO BROWSE THE OUTPUT DATA FILE?  (Y OR N)
```

```
C    -RETURN &REAL ARGS
C    &IF &1 EQ Y &GOTO -YESANS
C    &IF &1 EQ N &GOTO -NOANS
C    CIRSCRN
C    &TYPE &1 IS NOT A VALID RESPONSE (MUST BE Y OR N)
C    &GOTO -RETURN
C    -YESANS
C    BROWSE DATAOUT DATA
C    EXIT
C    -NOANS
C    &TYPE THE OUTPUT IS WRITTEN TO THE FILE 'DATAOUT DATA.'
C    &TYPE REJECTED DATA (IF ANY) IS WRITTEN TO 'REJECT DATA.'
C    EXIT
C
C*************************************************************************
C
C    FILE DEFINITIONS
C
C
C      FILE 8 MCI DATA
C
C       ____ <COLUMN 1>
C      |
C      |
C      V
C     TOP OF FILE
C     201
C     221 222 224 225 226 227 228 229 231 232 233 235 238 239 241 242 243 245
C     246 247 248 249 251 254 256 257 261 262 263 265 266 267 268 271 272 273
C     <MORE DATA HERE>
C     202 1
C     END OF FILE
C
C
C
C      FILE 9 SPRINT DATA
C
C     <OF THE SAME TYPE DATA AS FILE 8>
C
C
C
C      FILE 10 TOLL DATA
C
C      (TOLL CALLS LISTED IN ANY ORDER USING THE FOLLOWING FORMAT)
C
C
C       ____ <COLUMN 1>
C      |
C      |
C      V
C     TOP OF FILE
C        2 1 HACKENSACK NJ 201 368    1.23
C        3 1 WESTBROOK  ME 207 856    1.72
C        7 1 WASHINGTON DC 202 697    3.68
C        3 1 LAS VEGAS  NV 702 734    1.43
C        5 1 RENO       NV 702 786    2.14
C        5 1 HIGHLD FLS NY 914 938    2.70
C        2 1 NASHUA     NH 603 885    1.23
C        2 1 OMAHA      NE 402 221    1.08
C        1 1 HOUSTON    TX 713 526     .64
C        3 1 HUNTSVILLE AL 205 882    1.72
C     END OF FILE
C
C
C
C
```

```
C     FILE 11 DATAOUT DATA
C     (THIS IS THE OUTPUT FILE)
C
C     FILE 12 REJECT DATA
C     (THIS OUTPUT FILE LISTS REJECTED DATA)
C
C     FILE 13 TERM
C     (TO THE TERMINAL FOR INTERACTIVE USE)
C*****************************************************************
C  SUBROUTINES (AS THEY APPEAR IN THE MAIN PROGRAM)
C     SCCLIS - THIS SUBROUTINE PLACES SCC NETWORK LISTINGS OF AREA
C       CODES AND PREFIXES ON EACH NETWORK INTO AN ARRAY, NUM.
C     SORT - THIS SUBROUTINE SORTS TELEPHONE CALL DATA BY AREA CODE
C       AND PREFIX FOR USE IN THE MAIN PROGRAM.
C     QUERY - THIS SUBROUTINE INTERACTIVELY QUERIES THE USER FOR INPUT
C        DATA USED TO CALCULATE COSTS OF ACCESSING THE SCC NETWORKS
C        AND TO CALCULATE THE AT&T WATS COSTS (USING CURRENT AND PROPOSED
C        RATES).
C     ASK - THIS SUBROUTINE TAKES A CHARACTER STRING WHICH IS GIVEN
C       AS THE SUBROUTINE ARGUMENT AND OUTPUTS IT TO THE TERMINAL.
C     DIST - THIS SUBROUTINE CALCULATES THE DISTANCE TO A CALLED CITY
C       FROM THE DURATION, RATE PERIOD, AND COST OF THE CALL.
C     CALC - THIS SUBROUTINE CALCULATES THE COST OF EACH CALL IF IT
C       WERE MADE VIA AT&T MTS, MCI EXECUNET, AND SPRINT (BASED ON
C       DURATION OF CALL, RATE PERIOD, MILEAGE, AND, FOR MCI EXECUNET,
C       NETWORK OR NON-NETWORK CITY), SUMS THE COSTS OF CALLS (WITHIN
C       EACH RATE PERIOD, NETWORK OR NON-NETWORK CITY) FOR EACH CARRIER
C       FOR USE IN THE AT&T WATS, MCI WATS, AND DIRECT SPRINT COST
C       CALCULATIONS PERFORMED IN SUBROUTINE CALC2.
C     LINES - THIS SUBROUTINE CALCULATES ERLANGS OF CALLS DURING THE
C        BUSY HOUR AND OUTPUTS NUMBERS OF LINES AND GRADES OF SERVICE
C        FOR USE IN DETERMINING HOW MANY WATS OR ACCESS LINES TO USE
C        IN CALCULATING THE COSTS OF AT&T WATS, MCI WATS, AND DIRECT
C        SPRINT.
C     FACTOR - THIS FUNCTION CALCULATES FACTORIALS FOR USE IN
C       SUBROUTINE LINES.
C     CALC2 - THIS SUBROUTINE CALCULATES THE COST OF ALL CALLS IF THEY
C       WERE MADE VIA AT&T WATS, MCI WATS, AND DIRECT SPRINT (BASED ON
C       THE AVERAGE TIME PER ACCESS LINE PER RATE PERIOD).
C
C*****************************************************************
C  VARIABLE DEFINITIONS
C     ACCESS - A VARIABLE USED TO INDICATE IF CHARGES FOR CALLS TO
C        ACCESS THE SCC NETWORKS APPLY.
C     ACCDE - AREA CODE CALLED
```

```
C
C     ANS - A CHARACTER VARIABLE USED TO ANSWER QUESTIONS INTERACTIVELY
C
C     AVC0 - AVERAGE COST (PER MINUTE) OF AT&T MTS (ORIGINAL COST)
C     AVC1 - AVERAGE COST (PER MINUTE) OF AT&T MTS (PROPOSED RATES)
C     AVC1A - AVERAGE COST (PER MINUTE) OF AT&T WATS (CURRENT RATES)
C     AVC1B - AVERAGE COST (PER MINUTE) OF AT&T WATS (PROPOSED RATES)
C     AVC2 - AVERAGE COST (PER MINUTE) OF MCI EXECUNET
C     AVC2A - AVERAGE COST (PER MINUTE) OF MCI EXECUNET WITH ACCESS COSTS
C     AVC2B - AVERAGE COST (PER MINUTE) OF MCI WATS
C     AVC3 - AVERAGE COST (PER MINUTE) OF SPRINT
C     AVC3A - AVERAGE COST (PER MINUTE) OF SPRINT WITH ACCESS COSTS
C     AVC3B - AVERAGE COST (PER MINUTE) OF DIRECT SPRINT
C
C     AVTIME - AVERAGE TIME OF CALLS
C
C     COST - COST OF CALL
C
C     CSUM0 - SUM OF ORIGINAL AT&T MTS CALLS
C     CSUM1 - SUM OF COSTS OF CALLS MADE VIA AT&T MTS (PROPOSED RATES)
C     CSUM1A - SUM OF COSTS OF CALLS MADE VIA AT&T WATS (CURRENT RATES)
C     CSUM1B - SUM OF COSTS OF CALLS MADE VIA AT&T WATS (PROPOSED RATES)
C     CSUM2 - SUM OF COSTS OF CALLS MADE VIA MCI EXECUNET
C     CSUM2A - SUM OF COSTS OF CALLS MADE VIA MCI EXECUNET (INCLUDING
C        COSTS OF CALLS TO ACCESS)
C     CSUM2B - SUM OF COSTS OF CALLS MADE VIA MCI WATS
C     CSUM3 - SUM OF COSTS OF CALLS MADE VIA SPRINT
C     CSUM3A - SUM OF COSTS OF CALLS MADE VIA SPRINT (INCLUDING
C        COSTS OF CALLS TO ACCESS)
C     CSUM3B - SUM OF COSTS OF CALLS MADE VIA DIRECT SPRINT
C
C     FLAG(X) - AN ARRAY USED TO INDICATE IF THE AREA CODE AND PREFIX
C        OF THE CALL ARE ON THE SCC NETWORKS
C                FLAG(1) = MCI
C                FLAG(2) = GTE SPRINT
C
C     IREJ - TOTAL NUMBER OF REJECTED CALLS
C
C     ITCALL - TOTAL NUMBER OF CALLS
C
C     ITMIN - TOTAL MINUTES OF CALLS
C
C     ITMIN2 - TOTAL MINUTES OF CALLS LESS MINUTES OF CALLS UNABLE TO
C        BE PLACED VIA MCI (TO ALASKA)
C
C     LIMDIF - THE DIFFERENCE BETWEEN LIMHI AND LIMLO
C
C     LIMHI - (LIMIT HIGH) THE MAXIMUM NUMBER OF ACCESS LINES IN THE
C        RANGE OF NUMBERS OF LINES TO BE USED FOR SUBROUTINE CALC.
C
C     LIMLO - (LIMIT LOW) THE MINIMUM NUMBER OF ACCESS LINES IN THE
C        RANGE OF NUMBERS OF LINES TO BE USED FOR SUBROUTINE CALC.
C
C     MILES - DISTANCE (RANGE OF DISTANCES) TO CALLED CITY (CALCULATED
C        IN SUBROUTINE DIST)
C
C     MIN - LENGTH OF CALL IN MINUTES
C
C     NCALLS - TOTAL NUMBER OF CALL DATA SETS FROM THE FILE TOLL DATA
C
C     NLINES - NUMBER OF ACCESS LINES
C
C     NNX - PREFIX (NNX) CALLED
C
C     NOMCI - NUMBER OF CALLS UNABLE TO PLACED VIA MCI (TO ALASKA)
C
C     NOMIN - TOTAL MINUTES OF CALLS UNABLE TO BE PLACED VIA MCI
C        (TO ALASKA)
C
```

```
C     NUM(X,X,X) - AN ARRAY USED TO STORE AREA CODES AND
C        PREFIXES ON THE SCC NETWORKS
C           1ST POSITION - SCC
C              1 - MCI
C              2 - GTE SPRINT
C           2ND POSITION - TRANSLATED AREA CODE
C              EXAMPLE: 25 = AREA CODE 312
C           3RD POSITION - PREFIX (NNX)
C
C     NXA - A TRANSLATED VALUE FOR THE AREA CODE, ACODE.
C
C     OUTPUT - A VARIABLE USED TO INDICATE IF RESULTS OF SUBROUTINE CALC
C        ARE TO BE OUTPUT FOR EACH CALL DATA SET.
C
C     PERIOD - RATE PERIOD
C        1 = BUSINESS DAY
C        2 = EVENING
C        3 = NIGHT AND WEEKEND
C
C     PLACE - LOCATION CALLED
C
C     NOTE: VARIABLES USED AS SUBROUTINE ARGUMENTS, EVEN THOUGH THEY MAY
C     BE OUTPUT IN THE MAIN PROGRAM, ARE DEFINED IN THE SUBROUTINES.
C
C*************************************************************************
C
      INTEGER ACCDE,RSTEPC,RSTEPP,REGION
      INTEGER*2 BAND,PERIOD
      CHARACTER*13 PLACE
      CHARACTER*1 ANS
      LOGICAL*1 NUM(2,109,999)
      LOGICAL*1 FLAG(2),OUTPUT,ACCESS
      COMMON /A/NUM
      COMMON /B/MIN(2000),PERIOD(2000),PLACE(2000),ACODE(2000),
     -NNX(2000),COST(2000),FLAG
      DIMENSION MIN313(4),MIN323(4),MIN333(4)
C
      IREJ=ITCALI=ITMIN=0
C
      WRITE(13,100)
      CALL SCCLIS
      WRITE(13,101)
      CALL SORT(NCALLS)
      CALL QUERY(OUTPUT,ACCESS,RATE1,RATE1A,RATE2,RATE2A,RATE3,
     -RATE3A,RSTEPC,RSTEPP,REGION)
C
C
C     THE <IF(ACODE(I).EQ.   )THEN> STATEMENTS IN DO 10 TRANSLATE
C        THE AREA CODES TO SAVE SPACE IN THE ARRAY NUM, OTHERWISE
C        NUM WOULD NEED TO BE AT LEAST (2,919,999)
C
C
      DO 10 I=1,NCALLS
            IF(ACODE(I).EQ.201)THEN;NXA= 1;GO TO 20;END IF
            IF(ACODE(I).EQ.202)THEN;NXA= 2;GO TO 20;END IF
            IF(ACODE(I).EQ.203)THEN;NXA= 3;GO TO 20;END IF
            IF(ACODE(I).EQ.205)THEN;NXA= 4;GO TO 20;END IF
            IF(ACODE(I).EQ.206)THEN;NXA= 5;GO TO 20;END IF
            IF(ACODE(I).EQ.207)THEN;NXA= 6;GO TO 20;END IF
            IF(ACODE(I).EQ.208)THEN;NXA= 7;GO TO 20;END IF
            IF(ACODE(I).EQ.209)THEN;NXA= 8;GO TO 20;END IF
            IF(ACODE(I).EQ.212)THEN;NXA= 9;GO TO 20;END IF
            IF(ACODE(I).EQ.213)THEN;NXA=10;GO TO 20;END IF
            IF(ACODE(I).EQ.214)THEN;NXA=11;GO TO 20;END IF
            IF(ACODE(I).EQ.215)THEN;NXA=12;GO TO 20;END IF
            IF(ACODE(I).EQ.216)THEN;NXA=13;GO TO 20;END IF
            IF(ACODE(I).EQ.217)THEN;NXA=14;GO TO 20;END IF
```

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IF(ACCDE(I).EQ.218)THEN;NXA=15;GO TO 20;END IF
IF(ACCDE(I).EQ.219)THEN;NXA=16;GO TO 20;END IF
IF(ACCDE(I).EQ.301)THEN;NXA=17;GO TO 20;END IF
IF(ACCDE(I).EQ.302)THEN;NXA=18;GO TO 20;END IF
IF(ACCDE(I).EQ.303)THEN;NXA=19;GO TO 20;END IF
IF(ACCDE(I).EQ.304)THEN;NXA=20;GO TO 20;END IF
IF(ACCDE(I).EQ.305)THEN;NXA=21;GO TO 20;END IF
IF(ACCDE(I).EQ.307)THEN;NXA=22;GO TO 20;END IF
IF(ACCDE(I).EQ.308)THEN;NXA=23;GO TO 20;END IF
IF(ACCDE(I).EQ.309)THEN;NXA=24;GO TO 20;END IF
IF(ACCDE(I).EQ.312)THEN;NXA=25;GO TO 20;END IF
IF(ACCDE(I).EQ.313)THEN;NXA=26;GO TO 20;END IF
IF(ACCDE(I).EQ.314)THEN;NXA=27;GO TO 20;END IF
IF(ACCDE(I).EQ.315)THEN;NXA=28;GO TO 20;END IF
IF(ACCDE(I).EQ.316)THEN;NXA=29;GO TO 20;END IF
IF(ACCDE(I).EQ.317)THEN;NXA=30;GO TO 20;END IF
IF(ACCDE(I).EQ.318)THEN;NXA=31;GO TO 20;END IF
IF(ACCDE(I).EQ.319)THEN;NXA=32;GO TO 20;END IF
IF(ACCDE(I).EQ.401)THEN;NXA=33;GO TO 20;END IF
IF(ACCDE(I).EQ.402)THEN;NXA=34;GO TO 20;END IF
IF(ACCDE(I).EQ.404)THEN;NXA=35;GO TO 20;END IF
IF(ACCDE(I).EQ.405)THEN;NXA=36;GO TO 20;END IF
IF(ACCDE(I).EQ.406)THEN;NXA=37;GO TO 20;END IF
IF(ACCDE(I).EQ.408)THEN;NXA=38;GO TO 20;END IF
IF(ACCDE(I).EQ.409)THEN;NXA=39;GO TO 20;END IF
IF(ACCDE(I).EQ.412)THEN;NXA=40;GO TO 20;END IF
IF(ACCDE(I).EQ.413)THEN;NXA=41;GO TO 20;END IF
IF(ACCDE(I).EQ.414)THEN;NXA=42;GO TO 20;END IF
IF(ACCDE(I).EQ.415)THEN;NXA=43;GO TO 20;END IF
IF(ACCDE(I).EQ.417)THEN;NXA=44;GO TO 20;END IF
IF(ACCDE(I).EQ.419)THEN;NXA=45;GO TO 20;END IF
IF(ACCDE(I).EQ.501)THEN;NXA=46;GO TO 20;END IF
IF(ACCDE(I).EQ.502)THEN;NXA=47;GO TO 20;END IF
IF(ACCDE(I).EQ.503)THEN;NXA=48;GO TO 20;END IF
IF(ACCDE(I).EQ.504)THEN;NXA=49;GO TO 20;END IF
IF(ACCDE(I).EQ.505)THEN;NXA=50;GO TO 20;END IF
IF(ACCDE(I).EQ.507)THEN;NXA=51;GO TO 20;END IF
IF(ACCDE(I).EQ.509)THEN;NXA=52;GO TO 20;END IF
IF(ACCDE(I).EQ.512)THEN;NXA=53;GO TO 20;END IF
IF(ACCDE(I).EQ.513)THEN;NXA=54;GO TO 20;END IF
IF(ACCDE(I).EQ.515)THEN;NXA=55;GO TO 20;END IF
IF(ACCDE(I).EQ.516)THEN;NXA=56;GO TO 20;END IF
IF(ACCDE(I).EQ.517)THEN;NXA=57;GO TO 20;END IF
IF(ACCDE(I).EQ.518)THEN;NXA=58;GO TO 20;END IF
IF(ACCDE(I).EQ.601)THEN;NXA=59;GO TO 20;END IF
IF(ACCDE(I).EQ.602)THEN;NXA=60;GO TO 20;END IF
IF(ACCDE(I).EQ.603)THEN;NXA=61;GO TO 20;END IF
IF(ACCDE(I).EQ.605)THEN;NXA=62;GO TO 20;END IF
IF(ACCDE(I).EQ.606)THEN;NXA=63;GO TO 20;END IF
IF(ACCDE(I).EQ.607)THEN;NXA=64;GO TO 20;END IF
IF(ACCDE(I).EQ.608)THEN;NXA=65;GO TO 20;END IF
IF(ACCDE(I).EQ.609)THEN;NXA=66;GO TO 20;END IF
IF(ACCDE(I).EQ.612)THEN;NXA=67;GO TO 20;END IF
IF(ACCDE(I).EQ.614)THEN;NXA=68;GO TO 20;END IF
IF(ACCDE(I).EQ.615)THEN;NXA=69;GO TO 20;END IF
IF(ACCDE(I).EQ.616)THEN;NXA=70;GO TO 20;END IF
IF(ACCDE(I).EQ.617)THEN;NXA=71;GO TO 20;END IF
IF(ACCDE(I).EQ.618)THEN;NXA=72;GO TO 20;END IF
IF(ACCDE(I).EQ.619)THEN;NXA=73;GO TO 20;END IF
IF(ACCDE(I).EQ.701)THEN;NXA=74;GO TO 20;END IF
IF(ACCDE(I).EQ.702)THEN;NXA=75;GO TO 20;END IF
IF(ACCDE(I).EQ.703)THEN;NXA=76;GO TO 20;END IF
IF(ACCDE(I).EQ.704)THEN;NXA=77;GO TO 20;END IF
IF(ACCDE(I).EQ.707)THEN;NXA=78;GO TO 20;END IF
IF(ACCDE(I).EQ.712)THEN;NXA=79;GO TO 20;END IF
IF(ACCDE(I).EQ.713)THEN;NXA=80;GO TO 20;END IF
IF(ACCDE(I).EQ.714)THEN;NXA=81;GO TO 20;END IF
IF(ACCDE(I).EQ.715)THEN;NXA=82;GO TO 20;END IF
IF(ACCDE(I).EQ.716)THEN;NXA=83;GO TO 20;END IF
```

```
                IF(ACODE(I).EQ.717)THEN;NXA=84;GO TO 20;END IF
                IF(ACCDE(I).EQ.801)THEN;NXA=85;GO TO 20;END IF
                IF(ACODE(I).EQ.802)THEN;NXA=86;GO TO 20;END IF
                IF(ACCDE(I).EQ.803)THEN;NXA=87;GO TO 20;END IF
                IF(ACCDE(I).EQ.804)THEN;NXA=88;GO TO 20;END IF
                IF(ACODE(I).EQ.805)THEN;NXA=89;GO TO 20;END IF
                IF(ACCDE(I).EQ.806)THEN;NXA=90;GO TO 20;END IF
                IF(ACODE(I).EQ.808)THEN;NXA=91;GO TO 20;END IF
                IF(ACCDE(I).EQ.812)THEN;NXA=92;GO TO 20;END IF
                IF(ACCDE(I).EQ.813)THEN;NXA=93;GO TO 20;END IF
                IF(ACCDE(I).EQ.814)THEN;NXA=94;GO TO 20;END IF
                IF(ACCDE(I).EQ.815)THEN;NXA=95;GO TO 20;END IF
                IF(ACODE(I).EQ.816)THEN;NXA=96;GO TO 20;END IF
                IF(ACCDE(I).EQ.817)THEN;NXA=97;GO TO 20;END IF
                IF(ACCDE(I).EQ.818)THEN;NXA=98;GO TO 20;END IF
                IF(ACODE(I).EQ.901)THEN;NXA=99;GO TO 20;END IF
                IF(ACCDE(I).EQ.904)THEN;NXA=100;GO TO 20;END IF
                IF(ACCDE(I).EQ.906)THEN;NXA=101;GO TO 20;END IF
                IF(ACCDE(I).EQ.907)THEN;NXA=102;GO TO 20;END IF
                IF(ACODE(I).EQ.912)THEN;NXA=103;GO TO 20;END IF
                IF(ACCDE(I).EQ.913)THEN;NXA=104;GO TO 20;END IF
                IF(ACCDE(I).EQ.914)THEN;NXA=105;GO TO 20;END IF
                IF(ACODE(I).EQ.915)THEN;NXA=106;GO TO 20;END IF
                IF(ACCDE(I).EQ.916)THEN;NXA=107;GO TO 20;END IF
                IF(ACCDE(I).EQ.918)THEN;NXA=108;GO TO 20;END IF
                IF(ACODE(I).EQ.919)THEN;NXA=109;GO TO 20;END IF
C
CC      IF ACODE(I) IS NOT TRANSLATED ABOVE, THE CALL DATA WILL BE REJECTED
CC      AND OUTPUT TO THE FILE, REJECT DATA.  THE PROGRAM WILL CONTINUE AND
CC      PERFORM THE CALCULATIONS FOR THE NEXT CALL.
CC
CC      (IF THE CALL DATA FOR I = 1 IS REJECTED CERTAIN VARIABLES IN
CC      SUBROUTINE CALC WILL NOT BE INITIALIZED.  THIS WILL CAUSE A
CC      FATAL ERROR.)
C
        WRITE(12,103)MIN(I),PERIOD(I),PLACE(I),ACODE(I),NNX(I),COST(I)
C
        IREJ=IREJ+1
C
        GO TO 10
20      CONTINUE
C*************************************************************************
C*************************************************************************
C
CC      WHEN THE VARIABLE OUTPUT IS .TRUE., THE RESULTS OF SUBROUTINE CALC
CC      ARE OUTPUT FOR EACH CALL DATA SET.  THE FOLLOWING STATEMENTS ARE
CC      USED TO CONTROL THE HEADINGS FOR THIS OUTPUT.
C
        IF(I.EQ.1.AND.OUTPUT)THEN
           WRITE(11,104)ACODE(I),NNX(I)
           GO TO 30
        END IF
        IF(I.EQ.1)GO TO 30
        IF(ACODE(I).NE.ACODE(I-1).AND.OUTPUT)THEN
           WRITE(11,105)ACODE(I),NNX(I)
           GO TO 30
        END IF
        IF(NNX(I).NE.NNX(I-1).AND.OUTPUT)WRITE(11,106)NNX(I)
C*************************************************************************
C*************************************************************************
30      CONTINUE
C
        CALL DIST(I,BAND,MILES)
C*************************************************************************
C*************************************************************************
C
CC      IF THE DISTANCE CALCULATION IS SUCCESSFUL (INDICATED BY A VALUE
CC      OF MILES OTHER THAN 0) THE FOLLOWING <IF> STATEMENT WILL ALLOW
CC      CONTINUED PROCESSING OF THIS CALL DATA.  IF THE DISTANCE
```

```
C     CALCULATION IS UNSUCCESSFUL, THE CALL DATA IS OUTPUT TO THE FILE,
C     REJECT DATA AND THE PROGRAM WILL GO ON TO PROCESS THE DATA FOR
C     THE NEXT CALL.
C
C
      IF(MILES.NE.0) GO TO 40
         WRITE(12,107)MIN(I),PERIOD(I),PLACE(I),ACODE(I),NNX(I),COST(I)
         IREJ=IREJ+1
         GO TO 10
C*****************************************************************
C*****************************************************************
40     CONTINUE
C
      ITCALL=ITCALL+1
      ITMIN=ITMIN+MIN(I)
C
C
C     DO 50 SETS A FLAG (FLAG) IF THE AREA CODE (NXA) AND PREFIX (NNX(I))
C     IS ON THE SCC NETWORK DESIGNATED BY IN (IN = 1 FOR MCI,
C     IN = 2 FOR GTE SPRINT)    (IN OTHER WORDS, IF NUM(IN,NXA,NNX(I))
C     = .TRUE. A FLAG IS SET.)
C
C
      DO 50 IN=1,2
      FLAG(IN)=.FALSE.
      IF(NUM(IN,NXA,NNX(I)))FLAG(IN)=.TRUE.
50    CONTINUE
C*****************************************************************
C*****************************************************************
      CALL CALC(I,BAND,MILES,RATE1,RATE1A,RATE2,RATE2A,RATE3,
     -RATE3A,DISC2,DISC3,COST1,COST2,COST2A,COST3,COST3A,
     -CSUM0,CSUM1,CSUM2,CSUM2A,CSUM3,CSUM3A,
     -MIN11,MIN12,MIN13,MIN211,MIN221,MIN231,MIN212,MIN222,MIN232,
     -NCMCI,NOMIN,MIN311,MIN321,MIN331,MIN312,MIN322,MIN332,
     -MIN313,MIN323,MIN333)
C*****************************************************************
C*****************************************************************
C
C     WHEN THE VARIABLE OUTPUT IS .TRUE., THE DATA FOR EACH CALL IS
C     OUTPUT BY THE FOLLOWING STATEMENT.
C
      IF(OUTPUT)WRITE(11,108)MIN(I),PERIOD(I),PLACE(I),
     -COST(I),COST1,COST2,COST2A,COST3,COST3A
C
10    CONTINUE
C*****************************************************************
C*****************************************************************
C
C     THE FOLLOWING STATEMENTS CALCULATE THE AVERAGE TIME OF ALL CALLS
C     AND THE AVERAGE COSTS (PER MINUTE) OF EACH SERVICE
C
      AVTIME=(ITMIN+.0001)/ITCALL
      AVC0=CSUM0/ITMIN
      AVC1=CSUM1/ITMIN
      ITMIN2=ITMIN-NCMIN
      AVC2=CSUM2/ITMIN2
      AVC2A=CSUM2A/ITMIN2
      AVC3=CSUM3/ITMIN
      AVC3A=CSUM3A/ITMIN
C*****************************************************************
C*****************************************************************
C
C     WHEN THE VARIABLE ACCESS IS .TRUE., THE COSTS OF ACCESSING THE
C     SCC NETWORKS ARE CALCULATED.  THE FOLLOWING STATEMENTS PERMIT
C     THESE COSTS TO BE OUTPUT WITH THE REST OF THE CALCULATED COSTS.
C     (OTHERWISE THESE COSTS WILL BE ZERO AND NOT OUTPUT WITH THE REST
C     OF THE CALCULATED COSTS.)
C
      IF(ACCESS)THEN
```

```
      WRITE(11,109)ITCALL,ITMIN,AVTIME,IREJ,CSUM0,AVC0,CSUM1,AVC1,
     -CSUM2,AVC2,NOMCI,NOMIN,CSUM2A,AVC2A,NOMCI,NOMIN,CSUM3,AVC3,
     -CSUM3A,AVC3A
         GO TO 60
       END IF
       WRITE(11,110)ITCALL,ITMIN,AVTIME,IREJ,CSUM0,AVC0,CSUM1,AVC1,
     -CSUM2,AVC2,NOMCI,NOMIN,CSUM3,AVC3
C*************************************************************************
C*************************************************************************
60     CONTINUE
       CALL LINES(MIN11)
C
C      THE FOLLOWING <WRITE> STATEMENT OUTPUTS THE RATE STEPS AND REGION
C      WHICH WERE INPUT FOR USE IN SUBROUTINE CALC2
C
       WRITE(11,111)RSTEPC,RSTEPP,REGION
C
C*************************************************************************
C*************************************************************************
C
C      THE FOLLOWING STATEMENTS QUERY THE USER FOR THE NUMBER  OF
C      ACCESS LINES TO BE USED TO CALCULATE THE WATS AND DEDICATED
C      ACCESS SERVICE COSTS.
C
70     CALL ASK('                                                  ')
       CALL ASK('HOW MANY TOTAL WATS LINES OR DEDICATED            ')
       CALL ASK('ACCESS LINES DO YOU WANT TO USE TO                ')
       CALL ASK('CALCULATE DEDICATED ACCESS SERVICE COSTS?         ')
       CALL ASK('                                                  ')
       CALL ASK('(A RESPONSE OF 999 WILL ALLOW CALCULATION         ')
       CALL ASK('OF COSTS FOR A RANGE OF NUMBERS OF LINES)         ')
       READ(13,*)NLINES
       IF(NLINES.EQ.999)THEN
          CALL ASK('                                               ')
          CALL ASK('WHAT IS THE SMALLEST NUMBER IN THE RANGE OF    ')
          CALL ASK('NUMBERS OF LINES?                              ')
          READ(13,*)LIMLO
          CALL ASK('                                               ')
          CALL ASK('WHAT IS THE LARGEST NUMBER IN THE RANGE OF     ')
          CALL ASK('NUMBERS OF LINES?                              ')
          CALL ASK('                                               ')
          CALL ASK('(MUST BE WITHIN 10 LINES OF THE SMALLEST)      ')
          READ(13,*)LIMHI
          LIMDIF=LIMHI-LIMLO
          IF(LIMDIF.GT.10.OR.LIMHI.LE.LIMLO.OR.LIMLO.LT.1)THEN
             CALL ASK('INCORRECT LIMITS HAVE BEEN INPUT               ')
             CALL ASK('                                               ')
             GO TO 70
          END IF
C*************************************************************************
C*************************************************************************
C
C      IF THE CALCULATION OF COSTS IS FOR A RANGE OF VALUES OF NLINE
C      DO 80 CALCULATES AND OUTPUTS THE COSTS FOR EACH VALUE OF NLINE.
C
          DO 80 NLINES=LIMLO,LIMHI
             CALL CALC2(NLINES,RSTEPC,RSTEPP,REGION,MIN11,MIN12,MIN13,
     -CSUM1A,CSUM1B,MIN211,MIN221,MIN231,MIN212,MIN222,MIN232,
     -CSUM2B,MIN311,MIN321,MIN331,MIN312,MIN322,MIN332,
     -MIN313,MIN323,MIN333,CSUM3B)
C
C      CALCULATION OF AVERAGE COST (PER MINUTE) FOR EACH WATS OR
C      DEDICATED ACCESS SERVICE.
C
             AVC1A=CSUM1A/ITMIN
             AVC1B=CSUM1B/ITMIN
             AVC2B=CSUM2B/ITMIN2
             AVC3B=CSUM3B/ITMIN
             WRITE(11,112)NLINES,CSUM1A,AVC1A,CSUM1B,AVC1B,CSUM2B,AVC2B,
```

```
     -NCMCI,NOMIN,CSUM3B,AVC3B
80       CONTINUE
C
         GO TO 90
       END IF
C*************************************************************************
C*************************************************************************
C
C      IF THE CALCULATION OF COSTS IS FOR ONLY ONE VALUE OF NLINES THE
C      FOLLOWING STATEMENTS WILL CALCULATE AND OUTPUT THE COST FOR
C      THE ONE VALUE OF NLINES
C
       CALL CALC2(NLINES,RSTEPC,RSTEPP,REGION,MIN11,MIN12,MIN13,CSUM1A,
      -CSUM1B,MIN211,MIN221,MIN231,MIN212,MIN222,MIN232,CSUM2B,
      -MIN311,MIN321,MIN331,MIN312,MIN322,MIN332,
      -MIN313,MIN323,MIN333,CSUM3B)
C
C      CALCULATION OF AVERAGE COST (PER MINUTE) FOR EACH WATS OR
C      DEDICATED ACCESS SERVICE.
C
       AVC1A=CSUM1A/ITMIN
       AVC1B=CSUM1B/ITMIN
       AVC2B=CSUM2B/ITMIN2
       AVC3B=CSUM3B/ITMIN
C
C
C
       WRITE(11,112)NLINES,CSUM1A,AVC1A,CSUM1B,AVC1B,CSUM2B,AVC2B,
      -NCMCI,NOMIN,CSUM3B,AVC3B
C
90     CONTINUE
C*************************************************************************
C*************************************************************************
100    FORMAT(//1X,'EXECUTING.....',///1X,
      -'THIS PROGRAM WAS CREATED BY SCOTT L. KLINGLER, CAPTAIN, USAF IN',
      -/1X,'MARCH 1984.  ADDITIONAL INFORMATION ABOUT THIS PROGRAM CAN BE
      -',/1X,'OBTAINED IN THE PROGRAM DOCUMENTATION ITSELF OR IN KLINGLER
      -, SCOTT L.',//1X,'SPECIALIZED COMMON CARRIERS LONG DISTANCE ALTERN
      -ATIVES FOR MILITARY',/1X,'INSTALLATIONS, MASTERS THESIS, NAVAL POS
      -TGRADUATE SCHOOL,',/1X,'MONTEREY, CA, MARCH 1984.',///1X,
      -'READING SCC LISTS.....     IT WILL TAKE A WHILE.....')
101    FORMAT(//1X,'SORTING CALL DATA.....')
103    FORMAT(/1X,' INVALID AREA CODE IN INPUT DATA',/1X,
      -I3,1X,I1,1X,A13,1X,I3,1X,I3,1X,F6.2)
104    FORMAT(1X,'RATE PERIOD: 1 = DAY  2 = EVENING',
      -'   3 = NIGHT AND WEEKEND',/
      -80('*'),/1X,'AREA CODE ',I3,/1X,13('*'),/1X,'PREFIX ',I3,/1X,
      -10('-'),/57X,'MCI',12X,'SPRINT'/36X,'ORIG',3X,'NEW',11X,
      -'PLUS',12X,'PLUS',/12X,'RATE',20X,'AT&T',3X,'AT&T',3X,'MCI',3X,
      -'ACCESS',2X,'SPRINT',2X,'ACCESS',/1X,'MINUTES',3X,'PERIOD',5X,
      -'PLACE',9X,'COST',3X,'COST',3X,'COST',3X,'COST',4X,'COST',4X,
      -'COST',/80('-'))
105    FORMAT(/80('*'),/1X,'AREA CODE ',I3,/1X,13('*')/
      -57X,'MCI',12X,'SPRINT'/36X,'ORIG',3X,'NEW',11X,
      -'PLUS',12X,'PLUS',/12X,'RATE',20X,'AT&T',3X,'AT&T',3X,'MCI',3X,
      -'ACCESS',2X,'SPRINT',2X,'ACCESS',/1X,'MINUTES',3X,'PERIOD',5X,
      -'PLACE',9X,'COST',3X,'COST',3X,'COST',3X,'COST',4X,'COST',4X,
      -'COST',/80('-'),/1X,'PREFIX ',I3,/1X,10('-')/)
106    FORMAT(/1X,'PREFIX ',I3,/1X,10('-')/)
107    FORMAT(/1X,'DISTANCE CALCULATION UNSUCCESSFUL FOR INPUT DATA',/
      -1X,I3,1X,I1,1X,A13,1X,I3,1X,I3,1X,F6.2)
108    FORMAT(2X,I3,9X,I1,4X,A13,3X,F5.2,2X,F5.2,2X,F5.2,2X,F5.2,3X,
      -F5.2,3X,F5.2)
109    FORMAT(///1X,'TOTAL CALLS = ',I5,/
      -1X,'TOTAL MINUTES = ',I8,' MINUTES',/
      -1X,'AVERAGE TIME PER CALL = ',F5.1,' MINUTES PER CALL',/
      -1X,'NUMBER OF CALLS REJECTED = ',I3,//
      -1X,'ORIGINAL TOTAL AT&T MTS COST = $',F10.2,/
      -1X,'AVERAGE COST PER MINUTE = $',F6.3,//
```

```
     -1X,'TOTAL AT&T MTS COST (PROPOSED RATES)= $',F10.2,/
     -1X,'AVERAGE COST PER MINUTE = $',F6.3,//
     -1X,'TOTAL MCI EXECUNET COST = $',F10.2,/
     -1X,'AVERAGE COST PER MINUTE = $',F6.3,/
     -1X,I3,1X,'CALLS UNABLE TO BE COMPLETED (TO ALASKA) ',
     -'(MINUTES = ',I5,')',//
     -1X,'TOTAL MCI EXECUNET COST (WITH COST OF CALL TO ACCESS) = $',
     -F10.2,/1X,'AVERAGE COST PER MINUTE = $',F6.3,/
     -1X,I3,1X,'CALLS UNABLE TO BE COMPLETED (TO ALASKA) ',
     -'(MINUTES = ',I5,')',//1X,'TOTAL SPRINT COST = $',F10.2,/
     -1X,'AVERAGE COST PER MINUTE = $',F6.3,//
     -1X,'TOTAL SPRINT COST (WITH COST OF CALL TO ACCESS) = $',
     -F10.2/,1X,'AVERAGE COST PER MINUTE = $',F6.3)
110   FORMAT(///1X,'TOTAL CALLS = ',I5,/
     -1X,'TOTAL MINUTES = ',I8,' MINUTES',/
     -1X,'AVERAGE TIME PER CALL = ',F5.1,' MINUTES PER CALL',/
     -1X,'NUMBER OF CALLS REJECTED = ',I3,//
     -1X,'ORIGINAL TOTAL AT&T MTS COST = $',F10.2,/
     -1X,'AVERAGE COST PER MINUTE = $',F6.3,//
     -1X,'TOTAL AT&T MTS COST (PROPOSED RATES)= $',F10.2,/
     -1X,'AVERAGE COST PER MINUTE = $',F6.3,//
     -1X,'TOTAL MCI EXECUNET COST = $',F10.2,/
     -1X,'AVERAGE COST PER MINUTE = $',F6.3,/
     -1X,I3,1X,'CALLS UNABLE TO BE COMPLETED (TO ALASKA) ',
     -'(MINUTES = ',I5,')',//
     -1X,'TOTAL SPRINT COST = $',F10.2,/
     -1X,'AVERAGE COST PER MINUTE = $',F6.3)
111   FORMAT(///1X,'RATE STEP USED FOR AT&T WATS (CURRENT RATES) CALCUL
     -ATION = ',I3,/1X,'RATE STEP USED FOR AT&T WATS (PROPOSED RATES) CA
     -LCULATION = ',I3,/1X,'REGION USED FOR DIRECT SPRINT CALCULATION =
     -',I2)
112   FORMAT(//1X,'TOTAL NUMBER OF WATS LINES OR DEDICATED ACCESS ',
     -'LINES = ',I3,///1X,'TOTAL AT&T WATS COST (CURRENT RATES) = $',
     -F10.2,/1X,'AVERAGE COST PER MINUTE = $',F6.3,//
     -1X,'TOTAL AT&T WATS COST (PROPOSED RATES) = $',F10.2,/
     -1X,'AVERAGE COST PER MINUTE = $',F6.3,//
     -1X,'TOTAL MCI WATS COST = $',F10.2,/
     -1X,'AVERAGE COST PER MINUTE = $',F6.3,/
     -1X,I3,1X,'CALLS UNABLE TO BE COMPLETED (TO ALASKA) ',
     -'(MINUTES = ',I5,')',//
     -1X,'TOTAL DIRECT SPRINT COST = $',F10.2,/
     -1X,'AVERAGE COST PER MINUTE = $',F6.3)
      STOP
      END
$EJECT
      SUBROUTINE SCCIIS
C*****************************************************************
C
C     THIS SUBROUTINE PLACES SCC NETWORK LISTINGS OF AREA CODES AND
C     PREFIXES ON EACH NETWORK INTO AN ARRAY, NUM.
C
C*****************************************************************
C
C  VARIABLE DEFINITIONS
C
C     NNX1 - PREFIX ON SCC NETWORK IN AREA CODE NXA1
C
C     NXA - A TRANSLATED VALUE FOR THE AREA CODE, NXA1
C
C     NXACOD - A VARIABLE WHICH INDICATES, WHEN EQUAL TO 1, THAT ALL
C
C     NXA1 - AREA CODE ON SCC NETWORK
C
C*****************************************************************
C
C
      LOGICAL*1 NUM(2,109,999)
      COMMON /A/ NUM
      DIMENSION NNX1(999)
```

```
C*************************************************************************
C*************************************************************************
C
C     DO 10 INITIALIZES ALL POSITIONS OF THE ARRAY NUM TO .FAISE.
C
C
      DO 10 IN=1,2
      DO 10 NXA=1,109
      DO 10 NNN=1,999
10    NUM(IN,NXA,NNN)=.FALSE.
C*************************************************************************
C*************************************************************************
C
C     DO 20 AND DO 30 READS THE AREA CODE (NXA1) AND A SPECIAL INDICATOR,
C     NXACOD FROM THE FILES MCI DATA AND SPRINT DATA.  AT END OF FILE IT
C     TRANSFERS OUT OF THE LOOP AND RETURNS TO THE CALLING PROGRAM.
C
C     THE <IF(NXA1.EQ.___)THEN;NXA=___...> STATEMENTS IN DO 30 TRANSLATE
C     THE AREA CODES TO SAVE SPACE IN THE ARRAY, NUM.
C
C
      DO 20 IN=1,2
      I=IN+7
         DO 30 J=1,999
         READ(I,100)NXA1,NXACOD
            AT END
               GO TO 20
            END AT END
         IF(NXA1.EQ.201)THEN;NXA= 1;GO TO 40;END IF
         IF(NXA1.EQ.202)THEN;NXA= 2;GO TO 40;END IF
         IF(NXA1.EQ.203)THEN;NXA= 3;GO TO 40;END IF
         IF(NXA1.EQ.205)THEN;NXA= 4;GO TO 40;END IF
         IF(NXA1.EQ.206)THEN;NXA= 5;GO TO 40;END IF
         IF(NXA1.EQ.207)THEN;NXA= 6;GO TO 40;END IF
         IF(NXA1.EQ.208)THEN;NXA= 7;GO TO 40;END IF
         IF(NXA1.EQ.209)THEN;NXA= 8;GO TO 40;END IF
         IF(NXA1.EQ.212)THEN;NXA= 9;GO TO 40;END IF
         IF(NXA1.EQ.213)THEN;NXA=10;GO TO 40;END IF
         IF(NXA1.EQ.214)THEN;NXA=11;GO TO 40;END IF
         IF(NXA1.EQ.215)THEN;NXA=12;GO TO 40;END IF
         IF(NXA1.EQ.216)THEN;NXA=13;GO TO 40;END IF
         IF(NXA1.EQ.217)THEN;NXA=14;GO TO 40;END IF
         IF(NXA1.EQ.218)THEN;NXA=15;GO TO 40;END IF
         IF(NXA1.EQ.219)THEN;NXA=16;GO TO 40;END IF
         IF(NXA1.EQ.301)THEN;NXA=17;GO TO 40;END IF
         IF(NXA1.EQ.302)THEN;NXA=18;GO TO 40;END IF
         IF(NXA1.EQ.303)THEN;NXA=19;GO TO 40;END IF
         IF(NXA1.EQ.304)THEN;NXA=20;GO TO 40;END IF
         IF(NXA1.EQ.305)THEN;NXA=21;GO TO 40;END IF
         IF(NXA1.EQ.307)THEN;NXA=22;GO TO 40;END IF
         IF(NXA1.EQ.308)THEN;NXA=23;GO TO 40;END IF
         IF(NXA1.EQ.309)THEN;NXA=24;GO TO 40;END IF
         IF(NXA1.EQ.312)THEN;NXA=25;GO TO 40;END IF
         IF(NXA1.EQ.313)THEN;NXA=26;GO TO 40;END IF
         IF(NXA1.EQ.314)THEN;NXA=27;GO TO 40;END IF
         IF(NXA1.EQ.315)THEN;NXA=28;GO TO 40;END IF
         IF(NXA1.EQ.316)THEN;NXA=29;GO TO 40;END IF
         IF(NXA1.EQ.317)THEN;NXA=30;GO TO 40;END IF
         IF(NXA1.EQ.318)THEN;NXA=31;GO TO 40;END IF
         IF(NXA1.EQ.319)THEN;NXA=32;GO TO 40;END IF
         IF(NXA1.EQ.401)THEN;NXA=33;GO TO 40;END IF
         IF(NXA1.EQ.402)THEN;NXA=34;GO TO 40;END IF
         IF(NXA1.EQ.404)THEN;NXA=35;GO TO 40;END IF
         IF(NXA1.EQ.405)THEN;NXA=36;GO TO 40;END IF
         IF(NXA1.EQ.406)THEN;NXA=37;GO TO 40;END IF
         IF(NXA1.EQ.408)THEN;NXA=38;GO TO 40;END IF
         IF(NXA1.EQ.409)THEN;NXA=39;GO TO 40;END IF
         IF(NXA1.EQ.412)THEN;NXA=40;GO TO 40;END IF
         IF(NXA1.EQ.413)THEN;NXA=41;GO TO 40;END IF
```

```
      IF (NXA1.EQ.414) THEN;NXA=42;GO TO 40;END IF
      IF (NXA1.EQ.415) THEN;NXA=43;GO TO 40;END IF
      IF (NXA1.EQ.417) THEN;NXA=44;GO TO 40;END IF
      IF (NXA1.EQ.419) THEN;NXA=45;GO TO 40;END IF
      IF (NXA1.EQ.501) THEN;NXA=46;GO TO 40;END IF
      IF (NXA1.EQ.502) THEN;NXA=47;GO TO 40;END IF
      IF (NXA1.EQ.503) THEN;NXA=48;GO TO 40;END IF
      IF (NXA1.EQ.504) THEN;NXA=49;GO TO 40;END IF
      IF (NXA1.EQ.505) THEN;NXA=50;GO TO 40;END IF
      IF (NXA1.EQ.507) THEN;NXA=51;GO TO 40;END IF
      IF (NXA1.EQ.509) THEN;NXA=52;GO TO 40;END IF
      IF (NXA1.EQ.512) THEN;NXA=53;GO TO 40;END IF
      IF (NXA1.EQ.513) THEN;NXA=54;GO TO 40;END IF
      IF (NXA1.EQ.515) THEN;NXA=55;GO TO 40;END IF
      IF (NXA1.EQ.516) THEN;NXA=56;GO TO 40;END IF
      IF (NXA1.EQ.517) THEN;NXA=57;GO TO 40;END IF
      IF (NXA1.EQ.518) THEN;NXA=58;GO TO 40;END IF
      IF (NXA1.EQ.601) THEN;NXA=59;GO TO 40;END IF
      IF (NXA1.EQ.602) THEN;NXA=60;GO TO 40;END IF
      IF (NXA1.EQ.603) THEN;NXA=61;GO TO 40;END IF
      IF (NXA1.EQ.605) THEN;NXA=62;GO TO 40;END IF
      IF (NXA1.EQ.606) THEN;NXA=63;GO TO 40;END IF
      IF (NXA1.EQ.607) THEN;NXA=64;GO TO 40;END IF
      IF (NXA1.EQ.608) THEN;NXA=65;GO TO 40;END IF
      IF (NXA1.EQ.609) THEN;NXA=66;GO TO 40;END IF
      IF (NXA1.EQ.612) THEN;NXA=67;GO TO 40;END IF
      IF (NXA1.EQ.614) THEN;NXA=68;GO TO 40;END IF
      IF (NXA1.EQ.615) THEN;NXA=69;GO TO 40;END IF
      IF (NXA1.EQ.616) THEN;NXA=70;GO TO 40;END IF
      IF (NXA1.EQ.617) THEN;NXA=71;GO TO 40;END IF
      IF (NXA1.EQ.618) THEN;NXA=72;GO TO 40;END IF
      IF (NXA1.EQ.619) THEN;NXA=73;GO TO 40;END IF
      IF (NXA1.EQ.701) THEN;NXA=74;GO TO 40;END IF
      IF (NXA1.EQ.702) THEN;NXA=75;GO TO 40;END IF
      IF (NXA1.EQ.703) THEN;NXA=76;GO TO 40;END IF
      IF (NXA1.EQ.704) THEN;NXA=77;GO TO 40;END IF
      IF (NXA1.EQ.707) THEN;NXA=78;GO TO 40;END IF
      IF (NXA1.EQ.712) THEN;NXA=79;GO TO 40;END IF
      IF (NXA1.EQ.713) THEN;NXA=80;GO TO 40;END IF
      IF (NXA1.EQ.714) THEN;NXA=81;GO TO 40;END IF
      IF (NXA1.EQ.715) THEN;NXA=82;GO TO 40;END IF
      IF (NXA1.EQ.716) THEN;NXA=83;GO TO 40;END IF
      IF (NXA1.EQ.717) THEN;NXA=84;GO TO 40;END IF
      IF (NXA1.EQ.801) THEN;NXA=85;GO TO 40;END IF
      IF (NXA1.EQ.802) THEN;NXA=86;GO TO 40;END IF
      IF (NXA1.EQ.803) THEN;NXA=87;GO TO 40;END IF
      IF (NXA1.EQ.804) THEN;NXA=88;GO TO 40;END IF
      IF (NXA1.EQ.805) THEN;NXA=89;GO TO 40;END IF
      IF (NXA1.EQ.806) THEN;NXA=90;GO TO 40;END IF
      IF (NXA1.EQ.808) THEN;NXA=91;GO TO 40;END IF
      IF (NXA1.EQ.812) THEN;NXA=92;GO TO 40;END IF
      IF (NXA1.EQ.813) THEN;NXA=93;GO TO 40;END IF
      IF (NXA1.EQ.814) THEN;NXA=94;GO TO 40;END IF
      IF (NXA1.EQ.815) THEN;NXA=95;GO TO 40;END IF
      IF (NXA1.EQ.816) THEN;NXA=96;GO TO 40;END IF
      IF (NXA1.EQ.817) THEN;NXA=97;GO TO 40;END IF
      IF (NXA1.EQ.818) THEN;NXA=98;GO TO 40;END IF
      IF (NXA1.EQ.901) THEN;NXA=99;GO TO 40;END IF
      IF (NXA1.EQ.904) THEN;NXA=100;GO TO 40;END IF
      IF (NXA1.EQ.906) THEN;NXA=101;GO TO 40;END IF
      IF (NXA1.EQ.907) THEN;NXA=102;GO TO 40;END IF
      IF (NXA1.EQ.912) THEN;NXA=103;GO TO 40;END IF
      IF (NXA1.EQ.913) THEN;NXA=104;GO TO 40;END IF
      IF (NXA1.EQ.914) THEN;NXA=105;GO TO 40;END IF
      IF (NXA1.EQ.915) THEN;NXA=106;GO TO 40;END IF
      IF (NXA1.EQ.916) THEN;NXA=107;GO TO 40;END IF
      IF (NXA1.EQ.918) THEN;NXA=108;GO TO 40;END IF
      IF (NXA1.EQ.919) THEN;NXA=109;GO TO 40;END IF
C
```

```
C      IF NXA1 IS NOT TRANSLATED ABOVE, ITS VALUE WILL BE CUTPUT TC THE
C      DATAOUT DATA FIIE.  THIS WILL CAUSE A RETURN TO THE MAIN PROGRAM
C      ANE MAY CAUSE A FATAL ERROR.
C
          WRITE(11,102)NXA1
          GO TO 90
C*************************************************************************
C*************************************************************************
40        CONTINUE
C
C
C      IF NXACOD = 1 THE FOLIOWING <IF> STATEMENT SETS ALL POSITIONS OF
C      TEE ARRAY NUM(IN,NXA,___) TO .TRUE. INDICATING THAT ALL PREFIXES
C      IN THIS AREA CCIE (NXA -- TRANSLATED FROM NXA1) ARE CN THE SCC
C      NETWORK DESIGNATED BY IN (IN = 1 FOR MCI, IN = 2 FOR GTE SPRINT)
C      AND BYPASSES DC 70 AND DC 80.
C
C
          IF(NXACOD.EC.1)THEN
             DO 50 NNN=1,999
50           NUM(IN,NXA,NNN)=.TRUE.
             GO TC 30
          END IF
C*************************************************************************
C*************************************************************************
C
C      IF NXACOD IS NCI EQUAL TO 1 OR 0, ITS VALUE (AND THE VAIUE CF
C      NXA1) WILL BE CUTPUT TO THE DATAOUT DATA FILE.  THIS WILL CAUSE
C      A FETURN TO THE MAIN PROGRAM AND MAY CAUSE A FATAL ERROR.
C
        IF(NXACOD.EQ.1.OR.NXACOD.EQ.0)GO TO 60
          WRITE(11,103)NXA1,NXACOD
          GO TO 90
60      CONTINUE
C*************************************************************************
C*************************************************************************
C
C      DO 70 AND DO 8C READ THE PREFIXES (NNX1) OF AN AREA CODE (NXA)
C      THAT ARE ON THE SCC NETWCRK  (EXCEPT IF NXACOD = 1) AND SETS
C      TEE VALUE OF NUM(IN,NXA,NNX1) TO .TRUE..
C
C
       DO 70 K=1,999,18
       READ(I,101)NNX1(K),NNX1(K+1),NNX1(K+2),NNX1(K+3),NNX1(K+4),
      -NNX1(K+5),NNX1(K+6),NNX1(K+7),NNX1(K+8),NNX1(K+9),NNX1(K+10),
      -NNX1(K+11),NNX1(K+12),NNX1(K+13),NNX1(K+14),NNX1(K+15),NNX1(K+16),
      -NNX1(K+17)
       DO 80 L=1,18
       N=L-1
       IF(NNX1(K+N).EC.0)GO TO 30
       NUM(IN,NXA,NNX1(K+N))=.TRUE.
80     CCNTINUE
70     CCNTINUE
30     CCNTINUE
20     CCNTINUE
90     CCNTINUE
C*************************************************************************
C*************************************************************************
100    FORMAT(I3,1X,I1)
101    FCRMAT(18(I3,1X))
102    FORMAT(1X,'INCCRRECT DATA INPUT IN SUBROUTINE SCCLIS *** NXA1 = ',
      -I3)
103    FORMAT(1X,'INCCRRECT DATA INPUT IN SUBROUTINE SCCLIS *** NXA1 = ',
      -I3,2X,'NXACOD = ',I3)
       RETURN
       END
$EJECT
       SUBROUTINE SORT(NCALLS)
C*************************************************************************
```

```
C
C       THIS SUBROUTINE SORTS TELEPHONE CALL DATA BY AREA CODE
C       AND PREFIX FOR USE IN THE MAIN PROGRAM.
C
C**********************************************************************
C
C  VARIABLE DEFINITIONS
C
C       ACCDE - AREA CODE CALLED
C
C       COST - COST OF CALL
C
C       MIN - LENGTH OF CALL IN MINUTES
C
C       NCALLS - TOTAL NUMBER OF CALL DATA SETS FROM THE FILE TOLL DATA
C
C       NNX - PREFIX (NNX) CALLED
C
C       PERIOD - RATE PERIOD
C          1 = BUSINESS DAY
C          2 = EVENING
C          3 = NIGHT AND WEEKEND
C
C       PLACE - LOCATION CALLED
C
C       TEMP - A VARIABLE USED TO TEMPORARILY STORE VALUES OF MIN, PERIOD,
C          ACODE, AND NNX DURING SORTING
C
C       TEMPC - A VARIABLE USE TO TEMPORARILY STORE VALUES OF COST
C          DURING SORTING
C
C       TEMPP - A VARIABLE USE TO TEMPORARILY STORE VALUES OF PLACE
C          DURING SORTING
C
C
      INTEGER ACCDE
      INTEGER*2 PERIOD,TEMP
      CHARACTER*13 PLACE,TEMPP
      LOGICAL*1 FLAG(2)
      COMMON /B/MIN(2000),PERIOD(2000),PLACE(2000),ACODE(2000),
     -NNX(2000),COST(2000),FLAG
      N=NN=0
      DO 10 I=1,2000
      READ(10,100) MIN(I),PERIOD(I),PLACE(I),ACODE(I),NNX(I),COST(I)
      AT END
         GO TO 20
      END AT END
      NCALLS=I
10    CONTINUE
20    N=NCALLS-1
      DO 30 I=1,N
      INC=I+1
          DO 40 J=INC,NCALLS
          IF(ACODE(I).LT.ACODE(J))GO TO 40
          IF(ACODE(I).GT.ACCDE(J))GO TO 50
          IF(NNX(I).LE.NNX(J))GO TO 40
50             TEMP=MIN(I)
               MIN(I)=MIN(J)
               MIN(J)=TEMP
               TEMP=PERIOD(I)
               PERIOD(I)=PERIOD(J)
               PERIOD(J)=TEMP
               TEMPP=PLACE(I)
               PLACE(I)=PLACE(J)
               PLACE(J)=TEMPP
               TEMP=ACODE(I)
               ACCDE(I)=ACODE(J)
               ACODE(J)=TEMP
               TEMP=NNX(I)
```

```
                NNX(I)=NNX(J)
                NNX(J)=TEMP
                TEMPC=COST(I)
                COST(I)=COST(J)
                COST(J)=TEMPC
40          CONTINUE
30      CONTINUE
100     FORMAT(I3,1X,I1,1X,A13,1X,I3,1X,I3,1X,F6.2)
        RETURN
        END
$EJECT
        SUBROUTINE QUERY(OUTPUT,ACCESS,RATE1,RATE1A,RATE2,RATE2A,RATE3,
       -RATE3A,RSTEPC,RSTEPP,REGION)
C*****************************************************************
C
C       THIS SUBROUTINE INTERACTIVELY QUERIES THE USER FOR INPUT DATA
C       USED TO CALCULATE COSTS OF ACCESSING THE SCC NETWORKS AND TO
C       CALCULATE THE AT&T WATS COSTS (USING CURRENT AND PROPOSED RATES).
C
C*****************************************************************
C
C   VARIABLE DEFINITIONS
C
C       ACCESS - A VARIABLE USED TO INDICATE IF CHARGES FOR CALLS TO
C          ACCESS THE SCC NETWORKS APPLY.
C
C       ANS - A CHARACTER VARIABLE USED TO ANSWER QUESTIONS INTERACTIVELY
C
C       DISC - A VARIABLE USED TO READ THE DISCOUNT APPLIED FOR EVENING
C          AND NIGHT AND WEEKEND RATE PERIODS
C
C       DISC2 - THE DISCOUNT FACTOR FOR EVENING RATE PERIOD
C
C       DISC3 - THE DISCOUNT FACTOR FOR NIGHT AND WEEKEND RATE PERIOD
C
C       OUTPUT - A VARIABLE USED TO INDICATE IF RESULTS OF SUBROUTINE CALC
C          ARE TO BE OUTPUT FOR EACH CALL DATA SET.
C
C       RATEXX - RATE FOR CALL TO ACCESS MCI EXECUNET OR SPRINT
C          1ST POSITION - RATE PERIOD
C             1 - BUSINESS DAY
C             2 - EVENING
C             3 - NIGHT AND WEEKEND
C          2ND POSITION - FIRST OR ADDITIONAL MINUTE RATE
C             NO VALUE - FIRST MINUTE RATE
C             A - ADDITIONAL MINUTE RATE
C
C       REGION - GEOGRAPHICAL AREA IN WHICH DIRECT SPRINT CALLS ARE
C          ORIGINATED
C
C       RSTEPC - RATE STEP (CURRENT AT&T WATS TARIFF)
C
C       RSTEPP - RATE STEP (PROPOSED AT&T WATS TARIFF)
C
        INTEGER RSTEPC,RSTEPP,REGION
        CHARACTER*1 ANS
        LOGICAL*1 OUTPUT,ACCESS
        RATE1=RATE1A=RATE2=RATE2A=RATE3=RATE3A=0.0
1       CALL ASK('                                          ')
        CALL ASK('DO YOU WANT OUTPUT FOR EACH CALL? (Y OR N) ')
        CALL ASK('                                          ')
        CALL ASK('Y  WILL GIVE DATA FOR EACH CALL PLUS TOTALS')
        CALL ASK('N  WILL GIVE TOTALS ONLY                   ')
        READ(13,100)ANS
        IF(ANS.NE.'Y'.AND.ANS.NE.'N')THEN
           CALL ASK('ANSWER MUST BE  Y  OR  N                  ')
           GO TO 1
        END IF
```

```
C
      IF(ANS.EQ.'Y')OUTPUT=.TRUE.
      IF(ANS.EQ.'N')OUTPUT=.FALSE.
C
CCC
C2    CALL ASK('                                                  ')
      CALL ASK('IS THERE A CHARGE FOR THE CALL TO ACCESS          ')
      CALL ASK('THE MCI EXECUNET AND SPRINT NETWORKS?             ')
      CALL ASK('              (Y OR N)                            ')
      READ(13,100)ANS
      IF(ANS.NE.'Y'.AND.ANS.NE.'N')THEN
         CALL ASK('ANSWER MUST Y OR N                                 ')
         GO TO 2
      END IF
      ACCESS=.TRUE.
      IF (ANS.EQ.'N')THEN
         ACCESS=.FALSE.
         GO TO 5
      END IF
      CALL ASK('                                                  ')
      CALL ASK('THIS PROGRAM ASSUMES:                             ')
      CALL ASK('* MCI AND SPRINT LOCAL ACCESS NUMBERS ARE         ')
      CALL ASK('  IN THE SAME AREA                                ')
      CALL ASK('                                                  ')
      CALL ASK('* THE COST OF ACCESS IS BASED ON A FIRST          ')
      CALL ASK('  MINUTE RATE AND AN ADDITIONAL MINUTE RATE       ')
      CALL ASK('                                                  ')
      CALL ASK('* THE RATE PERIODS ARE AS FOLLOWS:                ')
      CALL ASK('------------------------------------------        ')
      CALL ASK('BUSINESS DAY                                      ')
      CALL ASK(' 8AM TO BUT NOT INCLUDING  5PM  MON-FRI           ')
      CALL ASK('------------------------------------------        ')
      CALL ASK('EVENING                                           ')
      CALL ASK(' 5PM TO BUT NOT INCLUDING 11PM  SUN-FRI           ')
      CALL ASK('------------------------------------------        ')
      CALL ASK('NIGHT AND WEEKEND                                 ')
      CALL ASK('11PM TO BUT NOT INCLUDING  8AM  ALL DAYS          ')
      CALL ASK(' 8AM TO BUT NOT INCLUDING 11PM    SAT             ')
      CALL ASK(' 8AM TO BUT NOT INCLUDING  5PM    SUN             ')
      CALL ASK('------------------------------------------        ')
      CALL ASK('                                                  ')
      CALL ASK('DO YOU STILL WANT TO CONTINUE TO ENTER DATA       ')
      CALL ASK('FOR CALCULATING THE COST OF ACCESSING THE         ')
      CALL ASK('SCC NETWORKS?          (Y OR N)                   ')
      CALL ASK('                                                  ')
      CALL ASK('Y  WILL CONTINUE AND ASK FOR RATES                ')
      CALL ASK('N  WILL PREVENT CALCULATON OF ACCESS COSTS        ')
      READ(13,100)ANS
      IF(ANS.NE.'Y'.AND.ANS.NE.'N')THEN
         CALL ASK('ANSWER MUST Y OR N                                 ')
         GO TO 2
      END IF
      ACCESS=.TRUE.
      IF (ANS.EQ.'N')THEN
         ACCESS=.FALSE.
         GO TO 5
      END IF
      CALL ASK('                                                  ')
      CALL ASK('FOR TEE DAY RATE PERIOD:                          ')
      CALL ASK('                                                  ')
      CALL ASK('WHAT IS THE FIRST MINUTE RATE?                    ')
      CALL ASK('(EXAMPLE: FOR $.03 PER MINUTE INPUT .03)          ')
      READ(13,*)RATE1
      CALL ASK('                                                  ')
      CALL ASK('WHAT IS THE ADDITIONAL MINUTE RATE?               ')
      CALL ASK('(EXAMPLE: FOR $.01 PER MINUTE INPUT .01)          ')
      READ(13,*)RATE1A
3     CALL ASK('                                                  ')
```

```
      CALL ASK('ARE THE CHARGES FOR THE OTHER RATE PERIODS ')
      CALL ASK('CALCULATED AS A PERCENTAGE OF THE DAY RATE?')
      CALL ASK('            (Y OR N)                       ')
      READ(13,100)ANS
      IF(ANS.NE.'Y'.AND.ANS.NE.'N')THEN
         CALL ASK('ANSWER MUST Y OR N                      ')
         GO TO 3
      END IF
      IF (ANS.EQ.'N')GO TO 4
      CALL ASK('                                          ')
      CALL ASK('WHAT IS THE DISCOUNT FOR THE EVENING RATE ')
      CALL ASK('PERIOD? (GIVE AS A REAL FRACTION.         ')
      CALL ASK('EXAMPLE: FOR A 30% DISCOUNT INPUT .3)     ')
      READ(13,*) DISC
      DISC2=1.-DISC
      CALL ASK('                                          ')
      CALL ASK('WHAT IS THE DISCOUNT FOR THE NIGHT AND    ')
      CALL ASK('WEEKEND RATE PERIOD? (GIVE AS A REAL      ')
      CALL ASK('FRACTION. EXAMPLE: FOR A 60% DISCOUNT     ')
      CALL ASK('INPUT .6)                                 ')
      READ(13,*) DISC
      DISC3=1.-DISC
      RATE2=RATE1*DISC2
      RATE2A=RATE1A*DISC2
      RATE3=RATE1*DISC3
      RATE3A=RATE1A*DISC3
      GO TO 5
4     CALL ASK('                                          ')
      CALL ASK('FOR THE EVENING RATE PERIOD:              ')
      CALL ASK('                                          ')
      CALL ASK('WHAT IS THE FIRST MINUTE RATE?            ')
      CALL ASK('(EXAMPLE: FOR $.01 PER MINUTE INPUT .01)  ')
      READ(13,*) RATE2
      CALL ASK('                                          ')
      CALL ASK('WHAT IS THE ADDITIONAL MINUTE RATE?       ')
      CALL ASK('(EXAMPLE: FOR $.01 PER MINUTE INPUT .01)  ')
      READ(13,*) RATE2A
      CALL ASK('                                          ')
      CALL ASK('FOR THE NIGHT AND WEEKEND RATE PERIOD:    ')
      CALL ASK('                                          ')
      CALL ASK('WHAT IS THE FIRST MINUTE RATE?            ')
      CALL ASK('(EXAMPLE: FOR $.01 PER MINUTE INPUT .01)  ')
      READ(13,*) RATE3
      CALL ASK('                                          ')
      CALL ASK('WHAT IS THE ADDITIONAL MINUTE RATE?       ')
      CALL ASK('(EXAMPLE: FOR $.01 PER MINUTE INPUT .01)  ')
      READ(13,*) RATE3A
C*************************************************************************
C*************************************************************************
C
C     THE RATE STEPS LISTED BELOW ARE FROM AMERICAN TELEPHONE AND
C     TELEGRAPH CO. FCC TARIFF NO. 259,  1 JAN 1984
C
C
5     CALL ASK('                                          ')
      CALL ASK('FOR CALCULATING THE AT&T WATS COSTS USING  ')
      CALL ASK('CURRENT RATES, WHAT IS THE RATE STEP?      ')
      CALL ASK('(THIS IS THE RATE STEP FOR SERVICE AREA 6) ')
      CALL ASK('                                          ')
      CALL ASK('RATE              STATES                  ')
      CALL ASK('STEP                                      ')
      CALL ASK('------------------------------------------')
      CALL ASK(' 19   -  ID, OR, WA                       ')
      CALL ASK('------------------------------------------')
      CALL ASK(' 20   -  AZ, CA, MT, NV, UT               ')
      CALL ASK('------------------------------------------')
      CALL ASK(' 21   -  AR, CO, IL, IN, IA, KS, LA, MI, MN,')
      CALL ASK('         MO, NE, NM, ND, OK, SD, TX, WI, WY')
      CALL ASK('------------------------------------------')
```

```
      CALL ASK(' 22  -  AL, CT, DE, DC, FL, GA, KY, ME, MD,')
      CALL ASK('        MA, MS, NH, NJ, NY, NC, OH, PA, RI,')
      CALL ASK('        SC, TN, VT, VA, WV                  ')
      CALL ASK('--------------------------------------------')
      CALL ASK('                                            ')
      CALL ASK('INPUT RATE STEP (19, 20, 21, OR 22)         ')
      READ(13,*) RSTEPC
      IF(RSTEPC.LT.19.OR.RSTEPC.GT.22)THEN
         CALL ASK('NOT A VALID RATE STEP                    ')
         GO TO 5
      END IF
C*************************************************************************
C*************************************************************************
C
C     THE RATE STEPS LISTED BELOW ARE FROM AT&T COMMUNICATIONS
C     FCC TARIFF NO. 2,  ISSUED 3 OCT 1983, EFFECTIVE DATE POSTPONED
C     INDEFINITELY.
C
C
6     CALL ASK('                                            ')
      CALL ASK('FOR CALCULATING THE AT&T WATS COSTS USING   ')
      CALL ASK('PROPOSED RATES, WHAT IS THE RATE STEP?      ')
      CALL ASK('                                            ')
      CALL ASK('RATE              STATES                    ')
      CALL ASK('STEP                                        ')
      CALL ASK('--------------------------------------------')
      CALL ASK(' 14  -  IA, KS, NE                          ')
      CALL ASK('--------------------------------------------')
      CALL ASK(' 15  -  AR, IL, MN, MO, ND, OK, SD          ')
      CALL ASK('--------------------------------------------')
      CALL ASK(' 16  -  CO, IN, LA, MS, TX, WI, WY          ')
      CALL ASK('--------------------------------------------')
      CALL ASK(' 17  -  AL, KY, MI, MT, NM, OH, TN          ')
      CALL ASK('--------------------------------------------')
      CALL ASK(' 18  -  AZ, CA, CT, DE, DC, FL, GA, ID, ME,')
      CALL ASK('        MD, MA, NV, NH, NJ, NY, NC, OR, PA,')
      CALL ASK('        RI, SC, UT, VT, VA, WA, WV          ')
      CALL ASK('--------------------------------------------')
      CALL ASK('                                            ')
      CALL ASK('INPUT RATE STEP (14, 15, 16, 17, OR 18)     ')
      READ(13,*) RSTEPP
      IF(RSTEPP.LT.14.OR.RSTEPP.GT.18)THEN
         CALL ASK('NOT A VALID RATE STEP                    ')
         GO TO 6
      END IF
7     CALL ASK('                                            ')
      CALL ASK('FOR CALCULATING THE DIRECT SPRINT COSTS,    ')
      CALL ASK('WHAT IS THE REGION OF ORIGINATION?          ')
      CALL ASK('                                            ')
      CALL ASK('REGION            STATES                    ')
      CALL ASK('--------------------------------------------')
      CALL ASK('  1  -  CO, GA, IL, LA, MO, OH, TX, WI      ')
      CALL ASK('--------------------------------------------')
      CALL ASK('  2  -  AZ, CA, DC, FL, MA, MD, NC, NY,     ')
      CALL ASK('        PA, WA                              ')
      CALL ASK('--------------------------------------------')
      CALL ASK('                                            ')
      CALL ASK('(NOTE: ONLY SPECIFIC LOCATIONS IN THESE     ')
      CALL ASK('STATES ARE CAPABLE OF DIRECT SPRINT CALL    ')
      CALL ASK('ORIGINATION)                                ')
      CALL ASK('                                            ')
      CALL ASK('INPUT REGION (1 OR 2)                       ')
      READ(13,*) REGION
      IF(REGION.NE.1.AND.REGION.NE.2)THEN
         CALL ASK('NOT A VALID REGION                       ')
         GO TO 7
      END IF
100   FORMAT(A1)
      RETURN
```

```
      END
$EJECT
      SUBROUTINE ASK(QUEST)
C*****************************************************************
C
C     THIS SUBROUTINE TAKES A CHARACTER STRING WHICH IS GIVEN
C     AS THE SUBROUTINE ARGUMENT AND OUTPUTS IT TO THE TERMINAL.
C
      CHARACTER*43 QUEST
      WRITE(13,100) QUEST
      RETURN
100   FORMAT(1X,A43)
      END
$EJECT
      SUBROUTINE DIST(I,BAND,MILES)
C*****************************************************************
C
C     THIS SUBROUTINE CALCULATES THE DISTANCE TO A CALLED CITY FROM
C     THE DURATION, RATE PERIOD, AND COST OF THE CALL.
C     THE RATES USED IN THIS SUBROUTINE ARE FROM AMERICAN TELEPHONE
C     AND TELEGRAPH CO. FCC TARIFF NO. 263, 1 FEB 1984.
C
C     NOTE: THE RATES USED IN THIS SUBROUTINE MUST BE THOSE FROM THE AT&T
C     TARIFF IN EFFECT WHEN THE CALLS WERE ORIGINALLY MADE AND BILLED.
C
C*****************************************************************
C
C     AT&T MTS CHARGES ARE BASED ON A RATE FOR THE FIRST MINUTE PLUS A
C     RATE FOR ADDITIONAL MINUTES IN EACH RATE PERIOD.  THE DURATION OF
C     A CALL IS ROUNDED UP TO THE NEXT HIGHER MINUTE.    COSTS ARE
C     CALCULATED AT THE DAY RATE, REGARDLESS OF THE RATE PERIOD, THEN
C     DISCOUNTED ACCORDING TO THE RATE PERIOD IN WHICH THE CALL WAS MADE.
C     TENTHS OF A CENT ARE TRUNCATED FROM THE COSTS CALCULATED FOR EACH
C     AT&T MTS CALL.
C
C*****************************************************************
C
C  VARIABLE DEFINITIONS
C
C     ACODE - AREA CODE CALLED
C
C     BAND - BAND (GEOGRAPHICAL REGION) FROM WHICH CALLS TO HAWAII ARE
C        ORIGINATED
C
C     COST - COST OF CALL
C     NOTE: .0001 IS ADDED TO COST TO CORRECT FOR MACHINE ROUNDING
C        ERROR.
C
C     COST1 - A VARIABLE USED TO ADD .0001 TO COST TO CORRECT FOR
C        MACHINE ROUNDING ERROR
C
C     DISC - DISCOUNT FACTOR.  AT&T OFFERS THE FOLLOWING DISCOUNTS FOR
C        CALLS:
C           EVENING  40 PERCENT (OR COST TIMES .6)
C           NIGHT AND WEEKEND  60 PERCENT (OR COST TIMES .4)
C           NIGHT AND WEEKEND TO ALASKA AND HAWAII  55 PERCENT (OR COST
C              TIMES .45) (AT&T CURRENT RATES ONLY)
C
C     (NOTE: AT&T CALCULATES THE COST OF ALL CALLS BY APPLYING THE
C        DAY RATES, MULTIPLYING BY DISCOUNT FACTOR, AND TRUNCATING
C        TENTHS OF A CENT.)
C
C     ICOST _ INTEGERED COST OF CALL TIMES 100
C
C     ITCOST - INTEGERED TEMPORARY COST (TCOST) TIMES 100
C
C     (NOTE: ICOST AND ITCOST ARE USED TO TRUNCATE TENTHS OF CENTS FOR
C     COMPARISON BETWEEN ORIGINAL COST (+ .0001) (ICOST) AND CALCULATED
C     COST (ITCOST) OF CALL)
```

```
C
C     MILES - DISTANCE (RANGE OF DISTANCES) TO CALLED CITY
C       1        1-10     MILES
C       2       11-22     MILES
C       3       23-55     MILES
C      *4       56-124    MILES
C       5      125-292    MILES
C       6      293-430    MILES
C       7      431-925    MILES
C       8      926-1910   MILES
C       9     1911-3000   MILES
C      10     3001-4250   MILES
C      11     4251-5750   MILES
C
C     *NOTE: MCI AND GTE SPRINT USE DISTANCE RANGES OF 56-70 AND 71-124
C     WHILE AT&T USES 56-124.  COSTS FOR ALL MCI AND GTE SPRINT CALLS
C     IN THE 56-124 MILE RANGE ARE CALCULATED AT THE 71-124 RATES.
C
C     MIN - LENGTH OF CALL IN MINUTES
C
C     NMIN - ADDITIONAL MINUTES (TOTAL MINUTES LESS 1 MINUTE). THIS IS
C        NECESSARY SINCE AT&T AND SPRINT CALLS ARE BILLED BY FIRST
C        MINUTE TIMES FIRST MINUTE RATE PLUS ADDITIONAL MINUTES TIMES
C        ADDITIONAL MINUTE RATE
C
C     PERIOD - RATE PERIOD
C        1 = BUSINESS DAY
C        2 = EVENING
C        3 = NIGHT AND WEEKEND
C
C     ICCST - TEMPORARY COST (CALCULATED COST OF CALL)
C
C
      INTEGER ACCDE,ICOST,ITCOST
      INTEGER*2 BAND,PERIOD
      CHARACTER*13 PLACE
      LOGICAL*1 FLAG(2)
      COMMON /B/MIN(2000),PERIOD(2000),PLACE(2000),ACODE(2000),
     -NNN(2000),COST(2000),FLAG
C
C     THE FOLLOWING TWO STATEMENTS ADD .0001 TO COST TO ACCOUNT FOR
C     MACHINE ROUNDING ERROR AND CALCULATE AN INTEGERED VALUE OF COST
C     TIMES 100 (ICOST) TO COMPARE WITH CALCULATED VALUES OF ITCOST
C     TO DETERMINE THE DISTANCE RANGE.
C
      COST1=COST(I)+.0001
      ICCST=IFIX(COST1*100.)
C
      NMIN=MIN(I)-1
      MILES=0
C
      IF(PERIOD(I).EQ.1)DISC=1.
      IF(PERIOD(I).EQ.2)DISC=.6
      IF(PERIOD(I).EQ.3)DISC=.4
      IF((ACODE(I).EQ.808.OR.ACODE(I).EQ.907)
     -.AND.PERIOD(I).EQ.3)DISC=.45
C*************************************************************
C*************************************************************
C     THE RATES USED IN THIS SUBROUTINE MUST BE THOSE IN EFFECT WHEN
C     THE CALLS WERE ORIGINALLY MADE AND BILLED.
C
C*************************************************************
C*************************************************************
C
C
C     CALCULATION OF DISTANCE (BAND) FOR CALLS TO HAWAII.
C
C     SINCE CALLS TO HAWAII ARE BILLED BY BAND AND NOT MILES, THIS
C     PART OF THE SUBROUTINE MAKES AN ASSUMPTION CONVERTING BAND 1
```

```
C     TO MILES=9, BAND 2 TO MILES=10, BAND 3 TO MILES=11 TO PERMIT
C     CALCULATING THE COSTS OF THESE CALLS VIA OTHER CARRIERS IN
C     SUBROUTINE CALC AND CALC2
C
      IF(ACODE(I).EQ.808)THEN
C
      TCCST=(.74+(NMIN*.49))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)THEN;BAND=1;MILES=9;END IF
C
      TCCST=(.76+(NMIN*.53))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)THEN;BAND=2;MILES=10;END IF
C
      TCCST=(.79+(NMIN*.55))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)THEN;BAND=3;MILES=11;END IF
C
      GO TO 10
      END IF
C
C
C*****************************************************************
C*****************************************************************
C
C     CALCULATION OF DISTANCE (MILES) FOR CALLS TO ALASKA
C
      IF(ACODE(I).EQ.907)THEN
C
      TCCST=(.62+(NMIN*.43))*DISC+.0001
      ITCOST=IFIX(TCOST*100.)
      IF(ITCOST.EQ.ICCST)MILES=7
C
      TCCST=(.64+(NMIN*.46))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=8
C
      TCCST=(.74+(NMIN*.54))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=9
C
      TCCST=(.79+(NMIN*.62))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=10
C
      TCCST=(.87+(NMIN*.70))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=11
C
      GO TO 10
      END IF
C*****************************************************************
C*****************************************************************
C
C     CALCULATION OF DISTANCE (MILES) FOR ALL CALLS EXCEPT TO HAWAII
C     AND ALASKA
C
      TCCST=(.32+(NMIN*.16))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=1
C
      TCCST=(.40+(NMIN*.22))*DISC+.0001
      ITCOST=IFIX(TCOST*100.)
      IF(ITCOST.EQ.ICOST)MILES=2
C
      TCCST=(.48+(NMIN*.28))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=3
```

```
C
      TCCST=(.57+(NMIN*.37))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=4
C
      TCCST=(.58+(NMIN*.39))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=5
C
      TCCST=(.59+(NMIN*.42))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=6
C
      TCCST=(.62+(NMIN*.43))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=7
C
      TCCST=(.64+(NMIN*.44))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=8
C
      TCCST=(.74+(NMIN*.49))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=9
C
      TCCST=(.76+(NMIN*.51))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=10
C
      TCCST=(.79+(NMIN*.53))*DISC+.0001
      ITCOST=IFIX(TCCST*100.)
      IF(ITCOST.EQ.ICCST)MILES=11
C
10    CONTINUE
      RETURN
      END
$EJECT
      SUBROUTINE CALC(I,BAND,MILES,RATE1,RATE1A,RATE2,RATE2A,RATE3,
     -RATE3A,DISC2,DISC3,COST1,COST2,COST2A,COST3,COST3A,
     -CSUM0,CSUM1,CSUM2,CSUM2A,CSUM3,CSUM3A,
     -MIN11,MIN12,MIN13,MIN211,MIN221,MIN231,MIN212,MIN222,MIN232,
     -NCMCI,NOMIN,MIN311,MIN321,MIN331,MIN312,MIN322,MIN332,
     -MIN313,MIN323,MIN333)
C*************************************************************
C
C     THIS SUBROUTINE CALCULATES THE COST OF EACH CALL IF IT WERE MADE
C     VIA AT&T MTS (PROPOSED RATES), MCI EXECUNET, AND SPRINT (BASED
C     ON DURATION OF CALL, RATE PERIOD, MILEAGE, AND, FOR MCI EXECUNET,
C     NETWORK OR NON-NETWORK CITY), AND SUMS THE COSTS OF CALLS (WITHIN
C     EACH RATE PERIOD, NETWORK OR NON-NETWORK CITY) FOR EACH CARRIER
C     FOR USE IN THE AT&T WATS, MCI WATS, AND DIRECT SPRINT COST
C     CALCULATIONS PERFORMED IN SUBROUTINE CALC2.
C
C     RATES USED IN THIS SUBROUTINE ARE FROM THE FOLLOWING TARIFFS:
C
C     AT&T MTS (PROPOSED RATES)
C
C        AT&T COMMUNICATIONS TARIFF FCC NO. 1, PP 56, 59, ISSUED
C           3 OCT 1983, EFFECTIVE DATE POSTPONED INDEFINITELY.
C
C     MCI EXECUNET
C
C        MCI TELECOMMUNICATIONS CORPORATION TARIFF FCC NO.1, P 19,
C           1 APR 1983.
C
C     SPRINT
C
C        GTE SPRINT COMMUNICATIONS CORPORATION TARIFF FCC NO. 11, P 34,
C           5 JAN 1984.
```

```
C
C*****************************************************************
C
C     METHODS OF APPLYING THE TARIFFS ARE DESCRIBED BELOW.
C
C     AT&T MTS AND SPRINT CHARGES ARE BASED ON A RATE FOR THE FIRST
C     MINUTE PLUS A RATE FOR ADDITIONAL MINUTES IN EACH RATE PERIOD,
C     WHILE MCI EXECUNET HAS A SINGLE RATE FOR ALL MINUTES IN A RATE
C     PERIOD.  ALL OF THESE SERVICES ROUND UP THE DURATION OF THE CALL
C     TO THE NEXT HIGHER MINUTE--THEY BILL IN ONE MINUTE INCREMENTS.
C     AT&T MTS COSTS ARE CALCULATED AT THE DAY RATE, REGARDLESS OF RATE
C     PERIOD, THEN DISCOUNTED ACCORDING TO THE RATE PERIOD IN WHICH THE
C     THE CALL WAS MADE.  (THE DISCOUNTS ARE 40 PERCENT FOR THE EVENING
C     RATE PERIOD AND 60 PERCENT FOR THE NIGHT AND WEEKEND RATE PERIOD.
C     A 55 PERCENT DISCOUNT IS APPLIED TO CALLS TO ALASKA AND HAWAII
C     DURING THE NIGHT AND WEEKEND RATE PERIOD UNDER THE CURRENT TARIFF.)
C     SPRINT SERVICE IS DISCOUNTED BASED UPON TOTAL DOLLAR AMOUNT OF THE
C     BILL.  MCI EXECUNET HAS SEPARATE RATES FOR CALLS TO NETWORK AND
C     NON-NETWORK CITIES.  TENTHS OF A CENT ARE TRUNCATED FROM THE COSTS
C     CALCULATED FOR EACH AT&T MTS CALL AND ARE ROUNDED FOR EACH MCI
C     EXECUNET AND SPRINT CALL.
C
C*****************************************************************
C
C  VARIABLE DEFINITIONS
C
C     ACODE - AREA CODE CALLED
C
C     BAND - BAND (GEOGRAPHICAL REGION) FROM WHICH CALLS TO HAWAII ARE
C        ORIGINATED
C
C     COST - COST OF CALL
C
C     COST1 - COST OF CALL IF MADE VIA AT&T MTS (PROPOSED RATES)
C     COST2 - COST OF CALL IF MADE VIA MCI EXECUNET
C     COST2A - COST OF CALL IF MADE VIA MCI EXECUNET (INCLUDING COST
C        OF CALL TO ACCESS)
C     COST3 - COST OF CALL IF MADE VIA SPRINT
C     COST3A - COST OF CALL IF MADE VIA SPRINT (INCLUDING
C        COST OF CALL TO ACCESS)
C
C     CSUM0 - SUM OF ORIGINAL AT&T MTS CALLS
C     CSUM1 - SUM OF COSTS OF CALLS MADE VIA AT&T MTS (PROPOSED RATES)
C     CSUM2 - SUM OF COSTS OF CALLS MADE VIA MCI EXECUNET
C     CSUM2A - SUM OF COSTS OF CALLS MADE VIA MCI EXECUNET (INCLUDING
C        COSTS OF CALLS TO ACCESS)
C     CSUM3 - SUM OF COSTS OF CALLS MADE VIA SPRINT
C     CSUM3A - SUM OF COSTS OF CALLS MADE VIA SPRINT (INCLUDING
C        COSTS OF CALLS TO ACCESS)
C
C     DISC - DISCOUNT FACTOR.  AT&T OFFERS THE FOLLOWING DISCOUNTS FOR
C        CALLS:
C           EVENING  40 PERCENT (OR COST TIMES .6)
C           NIGHT AND WEEKEND  60 PERCENT (OR COST TIMES .4)
C
C     (NOTE: AT&T CALCULATES THE COST OF ALL CALLS BY APPLYING THE
C        DAY RATES, MULTIPLYING BY DISCOUNT FACTOR, AND TRUNCATING
C        TENTHS OF A CENT.)
C
C     DISC2 - THE DISCOUNT FACTOR FOR EVENING RATE PERIOD
C
C     DISC3 - THE DISCOUNT FACTOR FOR NIGHT AND WEEKEND RATE PERIOD
C
C     FLAG(X) - AN ARRAY USED TO INDICATE IF THE AREA CODE AND PREFIX
C        OF THE CALL ARE ON THE SCC NETWORKS
C              FLAG(1) = MCI
C              FLAG(2) = GTE SPRINT
C
```

```
C      I - THE NUMBER OF THE CALL IN THE ARRAY OF CALL DATA
C
C      ICOST1 - A TEMPORARY VALUE OF COST TIMES 100 USED TO TRUNCATE
C         TENTHS OF CENTS
C
C      MILES - DISTANCE (RANGE OF DISTANCES) TO CALLED CITY (CALCULATED
C         IN SUBROUTINE DIST)
C
C      MIN - LENGTH OF CALL IN MINUTES
C
C      MINXXX - SUM OF MINUTES
C         1ST DIGIT - CARRIER
C            1 - AT&T
C            2 - MCI
C            3 - GTE SPRINT
C         2ND DIGIT - RATE PERIOD
C            1 - BUSINESS DAY
C            2 - EVENING
C            3 - NIGHT AND WEEKEND
C         3RD DIGIT - NETWORK/NON-NETWORK
C            1 - TO NETWORK CITY
C            2 - TO NON-NETWORK CITY
C            3 - TO ALASKA OR HAWAII NON-NETWORK CITY (GTE SPRINT ONLY)
C            NO 3RD DIGIT - AT&T
C
C      NMIN - ADDITIONAL MINUTES (TOTAL MINUTES LESS 1 MINUTE) THIS IS
C         NECESSARY SINCE AT&T AND SPRINT CALLS ARE BILLED BY FIRST
C         MINUTE TIMES FIRST MINUTE RATE PLUS ADDITIONAL MINUTES TIMES
C         ADDITIONAL MINUTE RATE
C
C      NCMCI - NUMBER OF CALLS UNABLE TO PLACED VIA MCI (TO ALASKA)
C
C      NOMIN - TOTAL MINUTES OF CALLS UNABLE TO BE PLACED VIA MCI
C         (TO ALASKA)
C
C      PERIOD - RATE PERIOD
C         1 = BUSINESS DAY
C         2 = EVENING
C         3 = NIGHT AND WEEKEND
C
C      RATEXX - RATE FOR CALL TO ACCESS MCI EXECUNET OR SPRINT
C         1ST POSITION - RATE PERIOD
C            1 - BUSINESS DAY
C            2 - EVENING
C            3 - NIGHT AND WEEKEND
C         2ND POSITION - FIRST OR ADDITIONAL MINUTE RATE
C            NO VALUE - FIRST MINUTE RATE
C            A - ADDITIONAL MINUTE RATE
C
C
      INTEGER ACODE
      INTEGER*2 BAND,PERIOD
      CHARACTER*13 PLACE
      LOGICAL*1 FLAG(2)
      COMMON /B/MIN(2000),PERIOD(2000),PLACE(2000),ACODE(2000),
     -NNX(2000),COST(2000),FLAG
      DIMENSION MIN313(4),MIN323(4),MIN333(4)
C*****************************************************************
C*****************************************************************
C
C      THE FOLLOWING <IF> STATEMENT INITIALIZES THE VARIABLES IF THE DATA
C      BEING TRANSFERRED TO THIS SUBROUTINE IS FOR THE FIRST CALL IN
C      THE SET OF DATA
C
      IF(I.EQ.1)THEN
         CSUM0=CSUM1=CSUM2=CSUM2A=CSUM3=CSUM3A=0.0
         MIN11=MIN12=MIN13=0
```

```
            MIN211=MIN221=MIN231=0
            MIN212=MIN222=MIN232=0
            MIN311=MIN321=MIN331=0
            MIN312=MIN322=MIN332=0
            NOMCI=0
            NOMIN=0
            DO 1 J=1,4
1           MIN313(J)=MIN323(J)=MIN333(J)=0
         END IF
C*************************************************************************
C*************************************************************************
C
C        CALCULATION OF ADDITIONAL MINUTES
C
         NMIN=MIN(I)-1
C*************************************************************************
C*************************************************************************
C*************************************************************************
C*************************************************************************
C**********  AT&T MTS COST CALCULATION (PROPOSED RATES)  **************
C
C
         IF(PERIOD(I).EQ.1)DISC=1.
         IF(PERIOD(I).EQ.2)DISC=.6
         IF(PERIOD(I).EQ.3)DISC=.4
C*************************************************************************
C*************************************************************************
C
C        THE FOLLOWING CALCULATION APPLIES IF THE CALL IS (MADE VIA AT&T
C        MTS) TO HAWAII.
C
C
         IF(ACCDE(I).EQ.808)THEN
            IF(BAND.EQ.1)COST1=(.73+(NMIN*.43))*DISC
            IF(BAND.EQ.2)COST1=(.75+(NMIN*.45))*DISC
            IF(BAND.EQ.3)COST1=(.78+(NMIN*.47))*DISC
C
C*****SUM OF MINUTES IN EACH RATE PERIOD*********************************
C****FOR USE IN DIRECT SPRINT CALCULATION*******************************
C******FOR NON-NETWORK CALLS TO HAWAII***********************************
C
            IF(FLAG(2))GO TO 10
               DO 2 J=1,4
               N=J+7
               IF(PERIOD(I).EQ.1.AND.MILES.EQ.N)MIN313(J)=MIN313(J)+MIN(I)
               IF(PERIOD(I).EQ.2.AND.MILES.EQ.N)MIN323(J)=MIN323(J)+MIN(I)
2              IF(PERIOD(I).EQ.3.AND.MILES.EQ.N)MIN333(J)=MIN333(J)+MIN(I)
               GO TO 10
         END IF
C*************************************************************************
C*************************************************************************
C
C        THE FOLLOWING CALCULATION APPLIES IF THE CALL IS (MADE VIA AT&T
C        MTS) TO ALASKA.
C
C*****SUM OF MINUTES IN EACH RATE PERIOD*********************************
C****FOR USE IN DIRECT SPRINT CALCULATION*******************************
C***********FOR CALLS TO ALASKA***************************************
C
C
         IF(ACCDE(I).EQ.907)THEN
            IF(MILES.EQ.7)J=1
            IF(MILES.EQ.8)J=2
            IF(MILES.EQ.9)J=2
            IF(MILES.EQ.10)J=3
            IF(MILES.EQ.11)J=4
            IF(PERIOD(I).EQ.1)MIN313(J)=MIN313(J)+MIN(I)
            IF(PERIOD(I).EQ.2)MIN323(J)=MIN323(J)+MIN(I)
            IF(PERIOD(I).EQ.3)MIN333(J)=MIN333(J)+MIN(I)
```

```
      END IF
C
C*****COST CALCULATION*************************************************
C
      IF(MILES.EQ.1)CCST1=(.31+(NMIN*.16))*DISC
      IF(MILES.EQ.2)CCST1=(.39+(NMIN*.22))*DISC
      IF(MILES.EQ.3)CCST1=(.47+(NMIN*.28))*DISC
      IF(MILES.EQ.4)CCST1=(.56+(NMIN*.32))*DISC
      IF(MILES.EQ.5)CCST1=(.57+(NMIN*.34))*DISC
      IF(MILES.EQ.6)CCST1=(.58+(NMIN*.35))*DISC
      IF(MILES.EQ.7)COST1=(.61+(NMIN*.35))*DISC
      IF(MILES.EQ.8)CCST1=(.63+(NMIN*.38))*DISC
      IF(MILES.EQ.9)CCST1=(.73+(NMIN*.43))*DISC
      IF(MILES.EQ.10)COST1=(.75+(NMIN*.45))*DISC
      IF(MILES.EQ.11)COST1=(.78+(NMIN*.47))*DISC
10    CONTINUE
C
C     THE FOLLOWING TWO STATEMENTS TRUNCATE TENTHS OF CENTS OF COST
C     CALCULATED FOR AT&T MTS (PROPOSED RATES)
C
      ICCST1=IFIX((CCST1+.0001)*100.)
      CCST1=ICOST1/100.
C***********************************************************************
C*****SUM OF ORIGINAL COSTS OF CALLS*************************************
C
      CSUM0=CSUM0+COST(I)
C***********************************************************************
C***********************************************************************
C*****SUM OF COSTS OF CALLS WITH PROPOSED AT&T MTS RATES*****************
C
      CSUM1=CSUM1+COST1
C***********************************************************************
C***********************************************************************
C*****SUM OF MINUTES IN EACH RATE PERIOD*********************************
C
      IF(PERIOD(I).EQ.1)MIN11=MIN11+MIN(I)
      IF(PERIOD(I).EQ.2)MIN12=MIN12+MIN(I)
      IF(PERIOD(I).EQ.3)MIN13=MIN13+MIN(I)
C
C***********************************************************************
C***********************************************************************
C***********************************************************************
C***********************************************************************
C**********  MCI EXECUNET COST CALCULATION  ****************************
C
C
C***********************************************************************
C***********************************************************************
C**********  TO A NETWORK CITY  ****************************************
C
C***********************************************************************
C*****COST CALCULATION FOR DAY RATE PERIOD CALL**************************
C
      IF(FLAG(1))THEN
         IF(PERIOD(I).EQ.1)THEN
            IF(MILES.EQ.1)COST2=.1536*MIN(I)
            IF(MILES.EQ.2)COST2=.2100*MIN(I)
            IF(MILES.EQ.3)COST2=.2700*MIN(I)
            IF(MILES.EQ.4)COST2=.3280*MIN(I)
            IF(MILES.EQ.5)CCST2=.3424*MIN(I)
            IF(MILES.EQ.6)COST2=.3632*MIN(I)
            IF(MILES.EQ.7)CCST2=.3744*MIN(I)
            IF(MILES.EQ.8)COST2=.3840*MIN(I)
            IF(MILES.EQ.9)COST2=.4320*MIN(I)
            IF(MILES.EQ.10)COST2=.4320*MIN(I)
            IF(MILES.EQ.11)COST2=.4320*MIN(I)
C***********************************************************************
C     SUM OF MIN211 FOR USE IN SUBROUTINE CALC2
C
```

```
            MIN211=MIN211+MIN(I)
C
C     COST PLUS COST OF CALL TO ACCESS
C     THE (IFIX...) PORTION OF THIS STATEMENT TRUNCATES TENTHS OF CENTS
C     OF COST FOR CALL TO ACCESS
C
            COST2A=COST2+(IFIX((RATE1+(NMIN*RATE1A)+.0001)*100.)/100.)
            GO TO 20
         END IF
C*************************************************************************
C*****COST CALCULATION FOR EVENING RATE PERIOD CALL**********************
C
         IF(PERIOD(I).EQ.2) THEN
            IF(MILES.EQ.1)COST2=.0922*MIN(I)
            IF(MILES.EQ.2)COST2=.1260*MIN(I)
            IF(MILES.EQ.3)COST2=.1319*MIN(I)
            IF(MILES.EQ.4)COST2=.1536*MIN(I)
            IF(MILES.EQ.5)COST2=.1614*MIN(I)
            IF(MILES.EQ.6)COST2=.1728*MIN(I)
            IF(MILES.EQ.7)COST2=.1774*MIN(I)
            IF(MILES.EQ.8)COST2=.1816*MIN(I)
            IF(MILES.EQ.9)COST2=.2029*MIN(I)
            IF(MILES.EQ.10) COST2=.2029*MIN(I)
            IF(MILES.EQ.11) COST2=.2029*MIN(I)
C*************************************************************************
C     SUM OF MIN221 FOR USE IN SUBROUTINE CALC2
C
            MIN221=MIN221+MIN(I)
C
C     COST PLUS COST OF CALL TO ACCESS
C     THE (IFIX...) PORTION OF THIS STATEMENT TRUNCATES TENTHS OF CENTS
C     OF COST FOR CALL TO ACCESS
C
            COST2A=COST2+(IFIX((RATE2+(NMIN*RATE2A)+.0001)*100.)/100.)
            GO TO 20
         END IF
C*************************************************************************
C*****COST CALCULATION FOR NIGHT AND WEEKEND RATE PERIOD CALL************
C
         IF(PERIOD(I).EQ.3) THEN
            IF(MILES.EQ.1)COST2=.0614*MIN(I)
            IF(MILES.EQ.2)COST2=.0840*MIN(I)
            IF(MILES.EQ.3)COST2=.1080*MIN(I)
            IF(MILES.EQ.4)COST2=.1194*MIN(I)
            IF(MILES.EQ.5)COST2=.1255*MIN(I)
            IF(MILES.EQ.6)COST2=.1344*MIN(I)
            IF(MILES.EQ.7)COST2=.1379*MIN(I)
            IF(MILES.EQ.8)COST2=.1412*MIN(I)
            IF(MILES.EQ.9)COST2=.1579*MIN(I)
            IF(MILES.EQ.10) COST2=.1579*MIN(I)
            IF(MILES.EQ.11) COST2=.1579*MIN(I)
C*************************************************************************
C     SUM OF MIN231 FOR USE IN SUBROUTINE CALC2
C
            MIN231=MIN231+MIN(I)
C
C     COST PLUS COST OF CALL TO ACCESS
C     THE (IFIX...) PORTION OF THIS STATEMENT TRUNCATES TENTHS OF CENTS
C     OF COST FOR CALL TO ACCESS
C
            COST2A=COST2+(IFIX((RATE3+(NMIN*RATE3A)+.0001)*100.)/100.)
            GO TO 20
         END IF
      END IF
C*************************************************************************
C*************************************************************************
C**********  TO A NON-NETWORK CITY  ******************************
C
C*************************************************************************
```

```
C*****COST CALCULATICN FOR DAY RATE PERIOD CALL*************************
C
C       SINCE MCI DOES NOT OFFER SERVICE TO ALASKA, THE FCLLOWING <IF>
C       STATEMENT SUMS THE NUMBER AND TOTAL MINUTES OF CALLS UNABLE TO
C       BE COMPLETED TO ALASKA FOR OUTPUT
C
            IF(ACODE(I).EQ.907)THEN
               NOMCI=NOMCI+1
               NOMIN=NOMIN+MIN(I)
               COST2=0.0
               COST2A=0.0
               GO TO 20
            END IF
            IF(PERIOD(I).EQ.1)THEN
               IF(MILES.EQ.1)COST2=.1536*MIN(I)
               IF(MILES.EQ.2)COST2=.2100*MIN(I)
               IF(MILES.EQ.3)COST2=.2700*MIN(I)
               IF(MILES.EQ.4)COST2=.3600*MIN(I)
               IF(MILES.EQ.5)COST2=.3800*MIN(I)
               IF(MILES.EQ.6)COST2=.4100*MIN(I)
               IF(MILES.EQ.7)COST2=.4200*MIN(I)
               IF(MILES.EQ.8)COST2=.4300*MIN(I)
               IF(MILES.EQ.9)COST2=.4800*MIN(I)
               IF(MILES.EQ.10)COST2=.4800*MIN(I)
               IF(MILES.EQ.11)COST2=.4800*MIN(I)
C***************************************************************************
C       SUM OF MIN212 FOR USE IN SUBROUTINE CALC2
C
                  MIN212=MIN212+MIN(I)
C
C       COST PLUS COST OF CALL TO ACCESS
C       THE (IFIX...) PORTION OF THIS STATEMENT TRUNCATES TENTHS OF CENTS
C       OF COST FOR CALL TO ACCESS
C
                  COST2A=COST2+(IFIX((RATE1+(NMIN*RATE1A)+.0001)*100.)/100.)
                  GO TO 20
            END IF
C***************************************************************************
C*****COST CALCULATICN FOR EVENING RATE PERIOD CALL**********************
C
            IF(PERIOD(I).EQ.2)THEN
               IF(MILES.EQ.1)COST2=.0922*MIN(I)
               IF(MILES.EQ.2)COST2=.1260*MIN(I)
               IF(MILES.EQ.3)COST2=.1620*MIN(I)
               IF(MILES.EQ.4)COST2=.2160*MIN(I)
               IF(MILES.EQ.5)COST2=.2280*MIN(I)
               IF(MILES.EQ.6)COST2=.2460*MIN(I)
               IF(MILES.EQ.7)COST2=.2520*MIN(I)
               IF(MILES.EQ.8)COST2=.2580*MIN(I)
               IF(MILES.EQ.9)COST2=.2880*MIN(I)
               IF(MILES.EQ.10)COST2=.2880*MIN(I)
               IF(MILES.EQ.11)COST2=.2880*MIN(I)
C***************************************************************************
C       SUM OF MIN222 FOR USE IN SUBROUTINE CALC2
C
                  MIN222=MIN222+MIN(I)
C
C       COST PLUS COST OF CALL TO ACCESS
C       THE (IFIX...) PORTION OF THIS STATEMENT TRUNCATES TENTHS OF CENTS
C       OF COST FOR CALL TO ACCESS
C
                  COST2A=COST2+(IFIX((RATE2+(NMIN*RATE2A)+.0001)*100.)/100.)
                  GO TO 20
            END IF
C***************************************************************************
C*****COST CALCULATICN FOR NIGHT AND WEEKEND RATE PERIOD CALL*************
C
            IF(PERIOD(I).EQ.3)THEN
               IF(MILES.EQ.1)COST2=.0614*MIN(I)
```

```
            IF(MILES.EQ.2)COST2=.0840*MIN(I)
            IF(MILES.EQ.3)COST2=.1080*MIN(I)
            IF(MILES.EQ.4)COST2=.1440*MIN(I)
            IF(MILES.EQ.5)COST2=.1520*MIN(I)
            IF(MILES.EQ.6)COST2=.1640*MIN(I)
            IF(MILES.EQ.7)COST2=.1680*MIN(I)
            IF(MILES.EQ.8)COST2=.1720*MIN(I)
            IF(MILES.EQ.9)COST2=.1920*MIN(I)
            IF(MILES.EQ.10)COST2=.1920*MIN(I)
            IF(MILES.EQ.11)COST2=.1920*MIN(I)
C*************************************************************************
C     SUM OF MIN232 FOR USE IN SUBROUTINE CALC2
C
            MIN232=MIN232+MIN(I)
C
C     COST PLUS COST OF CALL TO ACCESS
C     THE (IFIX...) PORTION OF THIS STATEMENT TRUNCATES TENTHS OF CENTS
C     OF COST FOR CALL TO ACCESS
C
            COST2A=COST2+(IFIX((RATE3+(NMIN*RATE3A)+.0001)*100.)/100.)
            GO TO 20
         END IF
20     CONTINUE
C*************************************************************************
C     SUM OF COSTS OF CALLS VIA MCI EXECUNET
C
      CSUM2=CSUM2+COST2
C
C     SUM OF COSTS OF CALLS PLUS ACCESS COSTS
C
      CSUM2A=CSUM2A+COST2A
C
C
C*************************************************************************
C*************************************************************************
C*************************************************************************
C*************************************************************************
C**********  SPRINT COST CALCULATION  ************************************
C
C     THIS CALCULATION ASSUMES THE LOWEST TARIFF RATE (OVER $200 TOTAL
C     LONG DISTANCE BILL).  THIS IS A VALID ASSUMPTION FOR NEARLY
C     ALL MILITARY INSTALLATIONS.
C
C*************************************************************************
C*************************************************************************
C*****COST CALCULATION FOR DAY RATE PERIOD CALL***************************
C
      IF(PERIOD(I).EQ.1)THEN
         IF(MILES.EQ.1)COST3=(.2024+(NMIN*.1426))
         IF(MILES.EQ.2)COST3=(.2668+(NMIN*.1987))
         IF(MILES.EQ.3)COST3=(.3312+(NMIN*.2539))
         IF(MILES.EQ.4)COST3=(.4048+(NMIN*.3091))
         IF(MILES.EQ.5)COST3=(.4232+(NMIN*.3238))
         IF(MILES.EQ.6)COST3=(.4416+(NMIN*.3395))
         IF(MILES.EQ.7)COST3=(.4784+(NMIN*.3514))
         IF(MILES.EQ.8)COST3=(.4876+(NMIN*.3606))
         IF(MILES.EQ.9)COST3=(.5612+(NMIN*.4085))
         IF(MILES.EQ.10)COST3=(.5796+(NMIN*.4269))
         IF(MILES.EQ.11)COST3=(.5980+(NMIN*.4453))
C
C     COST PLUS COST OF CALL TO ACCESS
C     THE (IFIX...) PORTION OF THIS STATEMENT TRUNCATES TENTHS OF CENTS
C     OF COST FOR CALL TO ACCESS
C
            COST3A=COST3+(IFIX((RATE1+(NMIN*RATE1A)+.0001)*100.)/100.)
C*************************************************************************
C     SUM OF MIN311 FOR USE IN SUBROUTINE CALC2
C
            IF(FLAG(2))THEN
```

```
                MIN311=MIN311+MIN(I)
                GO TO 30
              END IF
C*************************************************************************
C     IF CALL IS TO ALASKA OR HAWAII (NON-NETWORK) MINUTES HAVE
C     ALREADY BEEN SUMMED AT BEGINNING OF PROGRAM
C
          IF(ACODE(I).EQ.808.OR.ACODE(I).EQ.907)GO TO 30
C*************************************************************************
C     SUM OF MIN312 FOR USE IN SUBROUTINE CALC2
C
          MIN312=MIN312+MIN(I)
C
          GO TO 30
        END IF
C
C*************************************************************************
C*************************************************************************
C*****COST CALCULATION FOR EVENING RATE PERIOD CALL**********************
C
        IF(PERIOD(I).EQ.2)THEN
          IF(MILES.EQ.1)COST3=(.1170+(NMIN*.0830))
          IF(MILES.EQ.2)COST3=(.1530+(NMIN*.1134))
          IF(MILES.EQ.3)COST3=(.1800+(NMIN*.1341))
          IF(MILES.EQ.4)COST3=(.2430+(NMIN*.1798))
          IF(MILES.EQ.5)COST3=(.2610+(NMIN*.1935))
          IF(MILES.EQ.6)COST3=(.2790+(NMIN*.2016))
          IF(MILES.EQ.7)COST3=(.2880+(NMIN*.2097))
          IF(MILES.EQ.8)COST3=(.2970+(NMIN*.2151))
          IF(MILES.EQ.9)COST3=(.3150+(NMIN*.2333))
          IF(MILES.EQ.10)COST3=(.3240+(NMIN*.2524))
          IF(MILES.EQ.11)COST3=(.3420+(NMIN*.2619))
C
C       COST PLUS COST OF CALL TO ACCESS
C       THE (IFIX...) PORTION OF THIS STATEMENT TRUNCATES TENTHS OF CENTS
C       OF COST FOR CALL TO ACCESS
C
            COST3A=COST3+(IFIX((RATE2+(NMIN*RATE2A)+.0001)*100.)/100.)
C*************************************************************************
C     SUM OF MIN321 FOR USE IN SUBROUTINE CALC2
C
            IF(FLAG(2))THEN
              MIN321=MIN321+MIN(I)
              GO TO 30
            END IF
C*************************************************************************
C     IF CALL IS TO ALASKA OR HAWAII (NON-NETWORK) MINUTES HAVE
C     ALREADY BEEN SUMMED AT BEGINNING OF PROGRAM
C
          IF(ACODE(I).EQ.808.OR.ACODE(I).EQ.907)GO TO 30
C*************************************************************************
C     SUM OF MIN322 FOR USE IN SUBROUTINE CALC2
C
          MIN322=MIN322+MIN(I)
C
          GO TO 30
        END IF
C
C*************************************************************************
C*************************************************************************
C*****COST CALCULATION FOR NIGHT AND WEEKEND RATE PERIOD CALL************
C
        IF(PERIOD(I).EQ.3)THEN
          IF(MILES.EQ.1)COST3=(.0528+(NMIN*.0527))
          IF(MILES.EQ.2)COST3=(.0704+(NMIN*.0703))
          IF(MILES.EQ.3)COST3=(.1232+(NMIN*.0950))
          IF(MILES.EQ.4)COST3=(.1584+(NMIN*.1143))
          IF(MILES.EQ.5)COST3=(.1672+(NMIN*.1267))
          IF(MILES.EQ.6)COST3=(.1760+(NMIN*.1346))
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```
         IF(MILES.EQ.7)COST3=(.1848+(NMIN*.1364))
         IF(MILES.EQ.8)COST3=(.1936+(NMIN*.1390))
         IF(MILES.EQ.9)COST3=(.2112+(NMIN*.1521))
         IF(MILES.EQ.10)COST3=(.2200+(NMIN*.1645))
         IF(MILES.EQ.11)COST3=(.2288+(NMIN*.1707))
C
C     COST PLUS COST OF CALL TO ACCESS
C     THE (IFIX...) PORTION OF THIS STATEMENT TRUNCATES TENTHS OF CENTS
C     OF COST FOR CALL TO ACCESS
C
           COST3A=COST3+(IFIX((RATE3+(NMIN*RATE3A)+.0001)*100.)/100.)
C*************************************************************
C     SUM OF MIN331 FOR USE IN SUBROUTINE CALC2
C
           IF(FLAG(2))THEN
              MIN331=MIN331+MIN(I)
              GO TO 30
           END IF
C*************************************************************
C     IF CALL IS TO ALASKA OR HAWAII (NON-NETWORK) MINUTES HAVE
C     ALREADY BEEN SUMMED AT BEGINNING OF PROGRAM
C
           IF(ACODE(I).EQ.808.OR.ACODE(I).EQ.907)GO TO 30
C*************************************************************
C     SUM OF MIN332 FOR USE IN SUBROUTINE CALC2
C
           MIN332=MIN332+MIN(I)
C
           GO TO 30
      END IF
C
30    CONTINUE
C*************************************************************
C     SUM OF COSTS OF CALLS VIA SPRINT
C
      CSUM3=CSUM3+COST3
C
C     SUM OF COSTS OF CALLS PLUS ACCESS COSTS
C
      CSUM3A=CSUM3A+CCST3A
C
      RETURN
      END
$EJECT
      SUBROUTINE LINES(MIN11)
C*************************************************************
C
C     THIS SUBROUTINE CALCULATES ERLANGS OF CALLS DURING THE
C     BUSY HOUR AND OUTPUTS NUMBERS OF LINES AND GRADES OF SERVICE
C     (CALCULATED USING THE ERLANG B EQUATION (SEE SMITH, SYDNEY F.,
C     TELEPHONY AND TELEGRAPHY, OXFORD UNIVERSITY PRESS, P 180, 1978.))
C     FOR USE IN DETERMINING HOW MANY WATS OR ACCESS LINES TO USE
C     IN CALCULATING THE COSTS OF AT&T WATS, MCI WATS, AND DIRECT
C     SPRINT.
C
C     NOTE:  THIS SUBROUTINE ASSUMES AN AVERAGE OF 22 BUSINESS DAYS IN
C     A MONTH AND APPROXIMATELY 17 PERCENT OF ALL CALLS MADE DURING THE
C     BUSINESS DAY (8 HOURS) OCCUR DURING THE BUSY HOUR.
C
C     THE ERLANG B EQUATION IS:
C
C                                N
C                           ERL    / N!
C           B = ----------------------------------
C                                2              N
C               1 + ERL + ERL   / 2! + ... + ERL  / N!
C
C*************************************************************
C
```

```
C  VARIABLE DEFINITIONS
C
C      B - BLOCKAGE (GRADE OF SERVICE) - PERCENTAGE OF CALLS NOT COMPLETED
C
C      ERL - ERLANGS OF TRAFFIC DURING THE BUSY HOUR
C
C      FACTOR - A FUNCTION WHICH CALCULATES THE FACTORIAL OF THE ARGUMENT
C
C      MIN11 - TOTAL MINUTES OF CALLING DURING THE DAY RATE PERIOD
C
C      N - NUMBER OF WATS OR ACCESS LINES
C
C      X - A TEMPORARY VARIABLE USED IN THE B CALCULATION FOR SUMMING THE
C          SERIES IN THE DENOMINATOR OF THE ERLANG B EQUATION
C
C
       REAL*8 FACTOR
       ERL=((MIN11/60.)/22.)*.17
       WRITE(11,100)ERL
       WRITE(13,101)ERL
       CALL ASK('HOUR THE FOLLOWING NUMBERS OF LINES WILL   ')
       CALL ASK('GIVE THE FOLLOWING GRADES OF SERVICE.      ')
       CALL ASK('(EXAMPLE: GRADE OF SERVICE = 0.050 MEANS   ')
       CALL ASK('5 OUT OF 100 ATTEMPTED CALLS ARE NOT       ')
       CALL ASK('COMPLETED.)                                ')
       CALL ASK('                                           ')
       X=0.
       DO 10 N=1,999
       X=X+(ERL**N/FACTOR(N))
       B=(ERL**N/FACTOR(N))/(1+X)
       IF(B.GT..3)GO TO 10
       IF(B.LT..001)GO TO 20
       WRITE(11,102)N,B
       WRITE(13,102)N,B
10     CONTINUE
20     CONTINUE
100    FORMAT(//1X,'BASED ON ',F5.2,' ERLANGS DURING THE BUSY HOUR THE F
      -OLLOWING',/1X,'NUMBER OF LINES WILL GIVE THE FOLLOWING GRADES OF S
      -ERVICE.',/1X,'(EXAMPLE: GRADE OF SERVICE = 0.050 MEANS 5 OUT OF 10
      -0'/1X,'ATTEMPTED CALLS ARE NOT COMPLETED.)'//)
101    FORMAT(//1X,'BASED ON ',F5.2,' ERLANGS DURING THE BUSY')
102    FORMAT(1X,'NUMBER OF LINES = ',I3,3X,'GRADE OF SERVICE = ',F5.3)
       RETURN
       END
       FUNCTION FACTOR(I)
C*****************************************************************
C
C      THIS FUNCTION CACULATES FACTORIALS FOR USE IN SUBROUTINE LINES
C
C
       REAL*8 FACTOR
       FACTOR=1.
       DO 10 N=1,I
          FACTOR=FACTOR*(N)
10     CONTINUE
       RETURN
       END
$EJECT
       SUBROUTINE CALC2(NLINES,RSTEPC,RSTEPP,REGION,MIN11,MIN12,MIN13,
      -CSUM1A,CSUM1B,MIN211,MIN221,MIN231,MIN212,MIN222,MIN232,CSUM2B,
      -MIN311,MIN321,MIN331,MIN312,MIN322,MIN332,MIN313,MIN323,MIN333,
      -CSUM3B)
C*****************************************************************
C
C      THIS SUBROUTINE CALCULATES THE COST OF ALL CALLS IF THEY WERE MADE
C      VIA AT&T WATS (CURRENT AND PROPOSED TARIFF RATES), MCI WATS, AND
C      DIRECT SPRINT (BASED ON THE AVERAGE TIME PER ACCESS LINE PER RATE
C      PERIOD).
C
```

```
C     RATES USED IN THIS SUBROUTINE ARE FROM THE FOLLOWING TARIFFS:
C
C     AT&T WATS (CURRENT RATES)
C
C        AMERICAN TELEPHONE AND TELEGRAPH CO. TARIFF FCC NO. 259,
C          PP 13-14.1, 1 JAN 1984.
C
C     AT&T WATS (PROPOSED RATES)
C
C        AT&T COMMUNICATIONS TARIFF FCC NO. 2, PP 74-75, ISSUED
C           3 OCT 1983, EFFECTIVE DATE POSTPONED INDEFINITELY.
C
C     MCI WATS
C
C        MCI TELECOMMUNICATIONS CORPORATION TARIFF FCC NO.1, PP 19.6-
C           19.7, 1 APR 1983.
C
C     DIRECT SPRINT
C
C        GTE SPRINT COMMUNICATIONS CORPORATION TARIFF FCC NO. 10, PP 42-
C           49, 5 JAN 1984.
C
C*************************************************************************
C
C     METHODS OF APPLYING THE TARIFFS ARE DESCRIBED BELOW.
C
C     AT&T WATS MEASURES THE DURATION OF A CALL IN ONE SECOND INCREMENTS,
C     MCI WATS USES THIRTY SECOND INCREMENTS, AND DIRECT SPRINT USES SIX
C     SECOND INCREMENTS.  ALL THREE OF THESE SERVICES HAVE A ONE MINUTE
C     MINIMUM AVERAGE TIME REQUIREMENT.  ALSO, ALL THREE HAVE THE SAME
C     POINTS AT WHICH THE RATES TAPER; 15, 40, AND 80 HOURS (OR EQUIV-
C     ALENT MINUTES).  COSTS ARE CALCULATED BASED ON AVERAGE USE PER LINE
C     PER RATE PERIOD.  IN OTHER WORDS, THE TOTAL USAGE IN EACH RATE
C     PERIOD FOR ALL LINES (WATS LINES OR DALS) IS DIVIDED BY THE NUMBER
C     OF LINES TO OBTAIN AN AVERAGE USE PER LINE PER RATE PERIOD.
C     (AT&T WATS ROUNDS THIS AVERAGE TO THE NEAREST TENTH OF AN HOUR.)
C     MCI WATS AND DIRECT SPRINT ALSO CALCULATE THE AVERAGE FOR CALLS TO
C     NETWORK AND NON-NETWORK CITIES.  THE AVERAGE USE PER LINE PER RATE
C     PERIOD AND THE PER LINE MONTHLY RECURRING CHARGES ARE USED TO
C     CALCULATE THE COST PER LINE.  THE COST PER LINE IS MULTIPLIED BY
C     THE TOTAL NUMBER OF LINES TO OBTAIN THE TOTAL COST.
C
C*************************************************************************
C
C     THE RESULTS OF THESE CALCULATIONS WILL BE LARGER THAN ACTUAL FOR
C     THE SERVICES THAT ARE BILLED IN LESS THAN ONE MINUTE INCREMENTS.
C     (IN OTHER WORDS, COSTS FOR THE CALLS WOULD BE LESS THAN THESE
C     CALCULATIONS WOULD INDICATE.)
C
C     IF EXACT LENGTH OF CALL DATA IS AVAILABLE THIS SUBROUTINE WILL
C     NEED TO BE CHANGED SINCE AT&T WATS BILLS CALLS IN ONE SECOND
C     INCREMENTS, DIRECT SPRINT BILLS CALLS IN SIX SECOND INCREMENTS,
C     AND MCI WATS BILLS CALLS IN THIRTY SECOND INCREMENTS.
C
C*************************************************************************
C
C  VARIABLE DEFINITIONS
C
C     CXXX - COST OF CALL
C        1ST DIGIT - CARRIER
C           1 - AT&T
C           2 - MCI
C           3 - GTE SPRINT
C        2ND DIGIT - RATE PERIOD
C           1 - BUSINESS DAY
C           2 - EVENING
C           3 - NIGHT AND WEEKEND
C        3RD DIGIT - NETWORK/NON-NETWORK
```

```
C          1 - TO NETWORK CITY
C          2 - TO NON-NETWORK CITY
C          3 - TO ALASKA OR HAWAII NON-NETWORK CITY (GTE SPRINT ONLY)
C          NO 3RD DIGIT - AT&T WATS (CURRENT RATES)
C          A - AT&T WATS (PROPOSED RATES)
C
C     CMFC1A - MONTHLY RECURRING CHARGES FOR AT&T WATS (CURRENT RATES)
C     CMFC1B - MONTHLY RECURRING CHARGES FOR AT&T WATS (PROPOSED RATES)
C     CMFC2B - MONTHLY RECURRING CHARGES FOR MCI WATS
C     CMFC3B - MONTHLY RECURRING CHARGES FOR DIRECT SPRINT
C
C     CSUM1A - SUM OF COSTS OF CALLS MADE VIA AT&T WATS (CURRENT RATES)
C     CSUM1B - SUM OF COSTS OF CALLS MADE VIA AT&T WATS (PROPOSED RATES)
C     CSUM2B - SUM OF COSTS OF CALLS MADE VIA MCI WATS
C     CSUM3B - SUM OF COSTS OF CALLS MADE VIA DIRECT SPRINT
C
C     HR11 - AVERAGE TIME (IN HOURS) PER ACCESS LINE FOR DAY RATE
C            PERIOD CALLS
C     HR12 - AVERAGE TIME (IN HOURS) PER ACCESS LINE FOR EVENING RATE
C            PERIOD CALLS
C     HR13 - AVERAGE TIME (IN HOURS) PER ACCESS LINE FOR NIGHT AND
C            WEEKEND RATE PERIOD CALLS
C
C     MXXX - AVERAGE TIME (IN MINUTES) PER ACCESS LINE
C        1ST DIGIT - CARRIER
C           2 - MCI
C           3 - GTE SPRINT
C        2ND DIGIT - RATE PERIOD
C           1 - BUSINESS DAY
C           2 - EVENING
C           3 - NIGHT AND WEEKEND
C        3RD DIGIT - NETWORK/NON-NETWORK
C           1 - TO NETWORK CITY
C           2 - TO NON-NETWORK CITY
C           3 - TO ALASKA OR HAWAII NON-NETWORK CITY (GTE SPRINT ONLY)
C
C     MINXXX - SUM OF MINUTES
C        1ST DIGIT - CARRIER
C           1 - AT&T
C           2 - MCI
C           3 - GTE SPRINT
C        2ND DIGIT - RATE PERIOD
C           1 - BUSINESS DAY
C           2 - EVENING
C           3 - NIGHT AND WEEKEND
C        3RD DIGIT - NETWORK/NON-NETWORK
C           1 - TO NETWORK CITY
C           2 - TO NON-NETWORK CITY
C           3 - TO ALASKA OR HAWAII NON-NETWORK CITY (GTE SPRINT ONLY)
C           NO 3RD DIGIT - AT&T
C
C     NLINES - NUMBER OF ACCESS LINES
C
C     RATEXX - RATE FOR AT&T WATS
C        1ST DIGIT - RATE PERIOD
C           1 - BUSINESS DAY
C           2 - EVENING
C           3 - NIGHT AND WEEKEND
C        2ND DIGIT - INTERVAL OF OF TOTAL USAGE TIME
C           1 - 15 HRS
C           2 - 25 HRS
C           3 - 40 HRS
C           4 - 80 HRS
C           NO 2ND DIGIT - NIGHT AND WEEKEND RATE
C
C     R3XXX - RATE FOR DIRECT SPRINT
C        1ST DIGIT - RATE PERIOD
C           1 - BUSINESS DAY
C           2 - EVENING
```

```
C          3 - NIGHT AND WEEKEND
C       2ND DIGIT - NON-NETWORK, OR ALASKA OR HAWAII NON-NETWORK CITY
C          2 - NON-NETWORK
C          3 - ALASKA OR HAWAII NON-NETWORK CITY
C       3RD DIGIT - INTERVAL OF OF TOTAL USAGE TIME
C          A -  900 MIN
C          B - 1500 MIN
C          C - 2400 MIN
C          D - 4800 MIN
C          NO 3RD DIGIT - NIGHT AND WEEKEND RATE
C
C     REGION - GEOGRAPHICAL AREA IN WHICH DIRECT SPRINT CALLS ARE
C        ORIGINATED
C
C     RSTEPC - RATE STEP (CURRENT AT&T WATS TARIFF)
C
C     RSTEPP - RATE STEP (PROPOSED AT&T WATS TARIFF)
C
C     TIME1 - TIME INTERVAL - 15 HRS OR  900 MIN
C     TIME2 - TIME INTERVAL - 25 HRS OR 1500 MIN
C     TIME3 - TIME INTERVAL - 15 HRS OR 2400 MIN
C     TIME4 - TIME INTERVAL - 15 HRS OR 4800 MIN
C
      INTEGER RSTEPC,RSTEPP,REGION
      REAL M211,M221,M231,M212,M222,M232,M311,M321,M331,M312,M322,M332,
     -M313,M323,M333
      DIMENSION MIN313(4),MIN323(4),MIN333(4)
      C313=C323=C333=0.0
      C3=0.0
      CSUM1A=CSUM1B=CSUM2B=CSUM3B=0.0
C*************************************************************
C*************************************************************
C*************************************************************
C*************************************************************
C**********  AT&T WATS  ******************************************
C
C*************************************************************
C*************************************************************
C*****CALCULATION OF AVERAGE TIME (IN HOURS) PER WATS LINE**********
C
      HR11=(MIN11/60.)/NLINES
      HR12=(MIN12/60.)/NLINES
      HR13=(MIN13/60.)/NLINES
C*************************************************************
C
C     DESIGNATION OF TIME INTERVALS (IN HOURS) FOR AT&T WATS CALCULATIONS
C
C
      TIME1=15.
      TIME2=25.
      TIME3=40.
      TIME4=80.
C*************************************************************
C*************************************************************
C*************************************************************
C*************************************************************
C**********  AT&T WATS (CURRENT RATES)  **************************
C
C     THE FOLLOWING <IF> STATEMENTS DEFINE THE RATES TO BE USED IN THE
C     CALCULATION BASED ON THE INPUT VALUE OF RSTEPC.
C
C
      CMEC1A=31.65
C
      IF(RSTEPC.EQ.19)THEN;RATE11=23.96;RATE12=21.32;RATE13=18.69;
      RATE14=15.81;RATE21=15.57;RATE22=13.86;RATE23=12.15;RATE24=10.28;
      RATE3=8.39;END IF
C
```

```
      IF(RSTEPC.EQ.20)THEN;RATE11=25.82;RATE12=22.98;RATE13=20.14;
      RATE14=17.04;RATE21=16.78;RATE22=14.94;RATE23=13.09;RATE24=11.08;
      RATE3=9.04;END IF
C
      IF(RSTEPC.EQ.21)THEN;RATE11=26.96;RATE12=23.99;RATE13=21.03;
      RATE14=17.79;RATE21=17.52;RATE22=15.59;RATE23=13.67;RATE24=11.56;
      RATE3=9.44;END IF
C
      IF(RSTEPC.EQ.22)THEN;RATE11=29.04;RATE12=25.85;RATE13=22.65;
      RATE14=19.17;RATE21=18.88;RATE22=16.80;RATE23=14.72;RATE24=12.46;
      RATE3=10.16;END IF
C*************************************************************
C*************************************************************
C*****COST CALCULATION FOR DAY RATE PERIOD CALLS**************
C
      IF(HR11.LE.TIME1)C11A=HR11*RATE11
      IF(HR11.GT.TIME1.AND.HR11.LE.TIME3)C11A=((HR11-TIME1)*RATE12)
     -+(TIME1*RATE11)
      IF(HR11.GT.TIME3.AND.HR11.LE.TIME4)C11A=((HR11-TIME3)*RATE13)
     -+(TIME2*RATE12)+(TIME1*RATE11)
      IF(HR11.GT.TIME4)C11A=((HR11-TIME4)*RATE14)+(TIME3*RATE13)
     -+(TIME2*RATE12)+(TIME1*RATE11)
C*************************************************************
C*************************************************************
C*****COST CALCULATION FOR EVENING RATE PERIOD CALLS**********
C
      IF(HR12.LE.TIME1)C12A=HR12*RATE21
      IF(HR12.GT.TIME1.AND.HR12.LE.TIME3)C12A=((HR12-TIME1)*RATE22)
     -+(TIME1*RATE21)
      IF(HR12.GT.TIME3.AND.HR12.LE.TIME4)C12A=((HR12-TIME3)*RATE23)
     -+(TIME2*RATE22)+(TIME1*RATE21)
      IF(HR12.GT.TIME4)C12A=((HR12-TIME4)*RATE24)+(TIME3*RATE23)
     -+(TIME2*RATE22)+(TIME1*RATE21)
C*************************************************************
C*************************************************************
C*****COST CALCULATION FOR NIGHT AND WEEKEND RATE PERIOD CALLS*****
C
      C13A=HR13*RATE3
C*************************************************************
C*************************************************************
C*****SUM OF COSTS IN ALL RATE PERIODS************************
C
      CSUM1A=(C11A+C12A+C13A+CMRC1A)*NLINES
C*************************************************************
C*************************************************************
C*************************************************************
C*************************************************************
C**********  AT&T WATS (PROPOSED RATES)  **********************
C
C     THE FOLLOWING <IF> STATEMENTS DEFINE THE RATES TO BE USED IN THE
C     CALCULATION BASED ON THE INPUT VALUE OF RSTEPP.
C
      CMRC1B=56.65
C
      IF(RSTEPP.EQ.14)THEN;RATE11=19.40;RATE12=17.27;RATE13=15.15;
      RATE14=12.81;RATE21=12.62;RATE22=11.23;RATE23=9.84;RATE24=8.33;
      RATE3=6.74;END IF
C
      IF(RSTEPP.EQ.15)THEN;RATE11=19.60;RATE12=17.47;RATE13=15.30;
      RATE14=12.94;RATE21=12.74;RATE22=11.35;RATE23=9.96;RATE24=8.41;
      RATE3=6.81;END IF
C
      IF(RSTEPP.EQ.16)THEN;RATE11=19.83;RATE12=17.65;RATE13=15.47;
      RATE14=13.09;RATE21=12.89;RATE22=11.48;RATE23=10.06;RATE24=8.51;
      RATE3=6.89;END IF
C
      IF(RSTEPP.EQ.17)THEN;RATE11=20.06;RATE12=17.85;RATE13=15.65;
      RATE14=13.23;RATE21=13.03;RATE22=11.61;RATE23=10.17;RATE24=8.61;
      RATE3=6.97;END IF
```

```
C
      IF(RSTEPP.EQ.18)THEN;RATE11=20.45;RATE12=18.19;RATE13=15.95;
      RATE14=13.48;RATE21=13.30;RATE22=11.82;RATE23=10.37;RATE24=8.77;
      RATE3=7.11;END IF
C*************************************************************
C*************************************************************
C*****COST CALCULATION FOR DAY RATE PERIOD CALLS**************
C
      IF(HR11.LE.TIME1)C11=HR11*RATE11
      IF(HR11.GT.TIME1.AND.HR11.LE.TIME3)C11=((HR11-TIME1)*RATE12)
     -+(TIME1*RATE11)
      IF(HR11.GT.TIME3.AND.HR11.LE.TIME4)C11=((HR11-TIME3)*RATE13)
     -+(TIME2*RATE12)+(TIME1*RATE11)
      IF(HR11.GT.TIME4)C11=((HR11-TIME4)*RATE14)+(TIME3*RATE13)
     -+(TIME2*RATE12)+(TIME1*RATE11)
C*************************************************************
C*************************************************************
C*****COST CALCULATION FOR EVENING RATE PERIOD CALLS**********
C
      IF(HR12.LE.TIME1)C12=HR12*RATE21
      IF(HR12.GT.TIME1.AND.HR12.LE.TIME3)C12=((HR12-TIME1)*RATE22)
     -+(TIME1*RATE21)
      IF(HR12.GT.TIME3.AND.HR12.LE.TIME4)C12=((HR12-TIME3)*RATE23)
     -+(TIME2*RATE22)+(TIME1*RATE21)
      IF(HR12.GT.TIME4)C12=((HR12-TIME4)*RATE24)+(TIME3*RATE23)
     -+(TIME2*RATE22)+(TIME1*RATE21)
C*************************************************************
C*************************************************************
C*****COST CALCULATION FOR NIGHT AND WEEKEND RATE PERIOD CALLS***********
C
      C13=HR13*RATE3
C*************************************************************
C*************************************************************
C*****SUM OF COSTS IN ALL RATE PERIODS***********************
C
      CSUM1B=(C11+C12+C13+CMRC1B)*NLINES
C*************************************************************
C
C     DESIGNATION OF TIME INTERVALS (IN MINUTES)
C     FOR MCI WATS AND DIRECT SPRINT CALCULATIONS
C
C
      TIME1=900.
      TIME2=1500.
      TIME3=2400.
      TIME4=4800.
C
C
C*************************************************************
C*************************************************************
C**********  MCI WATS  ***************************************
C
C*************************************************************
C*************************************************************
C*****CALCULATION OF AVERAGE TIME (IN MINUTES) PER ACCESS LINE***********
C
      M211=MIN211/NLINES
      M221=MIN221/NLINES
      M231=MIN231/NLINES
      M212=MIN212/NLINES
      M222=MIN222/NLINES
      M232=MIN232/NLINES
C
      CMRC2B=100.
C*************************************************************
C*************************************************************
C*****COST CALCULATION FOR DAY RATE PERIOD CALLS TO NETWORK CITIES*******
C
      IF(M211.LE.TIME1)C211=M211*.2721
```

```
      IF(M211.GT.TIME1.AND.M211.LE.TIME3)C211=((M211-TIME1)*.2420)
     -+(TIME1*.2721)
      IF(M211.GT.TIME3.AND.M211.LE.TIME4)C211=((M211-TIME3)*.2120)
     -+(TIME2*.2420)+(TIME1*.2721)
      IF(M211.GT.TIME4)C211=((M211-TIME4)*.1795)+(TIME3*.2120)
     -+(TIME2*.2420)+(TIME1*.2721)
C*************************************************************
C*************************************************************
C*****COST CALCULATICN FOR EVENING RATE PERIOD CALLS TC NETWORK CITIES***
C
      IF(M221.LE.TIME1)C221=M221*.1767
      IF(M221.GT.TIME1.AND.M221.LE.TIME3)C221=((M221-TIME1)*.1572)
     -+(TIME1*.1767)
      IF(M221.GT.TIME3.AND.M221.LE.TIME4)C221=((M221-TIME3)*.1378)
     -+(TIME2*.1572)+(TIME1*.1767)
      IF(M221.GT.TIME4)C221=((M221-TIME4)*.1166)+(TIME3*.1378)
     -+(TIME2*.1572)+(TIME1*.1767)
C*************************************************************
C*************************************************************
C*****COST CALCULATICN FOR NIGHT AND WEEKEND RATE PERIOD CALLS**********
C     TC NETWORK CITIES
C
      C231=M231*.1000
C*************************************************************
C*************************************************************
C*****COST CALCULATICN FOR DAY RATE PERIOD CALLS TO NON-NETWORK CITIES***
C
      C212=M212*.340
C*************************************************************
C*************************************************************
C*****COST CALCULATICN FOR EVENING RATE PERIOD CALLS*********************
C**************TO NCN-NETWCRK CITIES*********************************
C
      C222=M222*.248
C*************************************************************
C*************************************************************
C*****COST CALCULATICN FOR NIGHT AND WEEKEND RATE PERIOD CALLS**********
C**************TO NCN-NETWORK CITIES*********************************
C
      C232=M232*.152
C*************************************************************
C*************************************************************
C*****SUM OF COSTS IN ALL RATE PERIODS, NETWORK AND NON-NETWORK**********
C
      CSUM2B=(C211+C221+C231+C212+C222+C232+CMRC2B)*NLINES
C*************************************************************
C*************************************************************
C*************************************************************
C*************************************************************
C**********  DIRECT  SPRINT  *********************************************
C
C*************************************************************
C*************************************************************
C*****CALCULATION OF AVERAGE TIME (IN MINUTES) PER ACCESS LINE**********
C
      M311=MIN311/NLINES
      M321=MIN321/NLINES
      M331=MIN331/NLINES
      M312=MIN312/NLINES
      M322=MIN322/NLINES
      M332=MIN332/NLINES
C
      CMRC3B=100.
C*************************************************************
C*************************************************************
C*****COST CALCULATICN FOR DAY RATE PERIOD CALLS TO NETWORK CITIES*******
C
      IF(M311.LE.TIME3)C311=M311*.257
      IF(M311.GT.TIME3.AND.M311.LE.TIME4)C311=((M311-TIME3)*.222)
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```
     -+(TIME3*.257)
      IF(M311.GT.TIME4)C311=((M311-TIME4)*.194)+(TIME3*.222)
     -+(TIME3*.257)
C*****************************************************************
C*****************************************************************
C*****COST CALCULATICN FOR EVENING RATE PERIOD CALLS TC NETWORK CITIES***
C
      IF(M321.LE.TIME1)C321=M321*.187
      IF(M321.GT.TIME1.AND.M321.LE.TIME3)C321=((M321-TIME1)*.165)
     -+(TIME1*.187)
      IF(M321.GT.TIME3.AND.M321.LE.TIME4)C321=((M321-TIME3)*.145)
     -+(TIME2*.165)+(TIME1*.187)
      IF(M321.GT.TIME4)C321=((M321-TIME4)*.123)+(TIME3*.145)
     -+(TIME2*.165)+(TIME1*.187)
C*****************************************************************
C*****************************************************************
C*****COST CALCULATICN FOR NIGHT AND WEEKEND RATE PERIOD CALLS**********
C**********************TO NETWORK CITIES**********************************
C
      C331=M331*.108
C*****************************************************************
C*****************************************************************
C*****COST CALCULATICNS FOR CALLS TO NON-NETWORK CITIES*****************
C
C     THE FCLLOWING <IF> STATEMENTS DEFINE THE RATES TO BE USED IN THE
C     CALCULATION BASED ON THE INPUT VALUE OF REGION.
C
      IF(REGION.EQ.1)THEN;R312A=.3658;R312B=.3260;R312C=.2855;
      R312D=.2415;R322A=.2378;R322B=.2118;R322C=.1858;R322D=.1570;
      R332=.1271;END IF
      IF(REGION.EQ.2)THEN;R312A=.3816;R312B=.3395;R312C=.2976;
      R312D=.2516;R322A=.2481;R322B=.2206;R322C=.1935;R322D=.1636;
      R332=.1326;END IF
C*****************************************************************
C*****COST CALCULATICN FOR DAY RATE PERIOD CALLS TO NON-NETWORK CITIES***
C
      IF(M312.LE.TIME1)C312=M312*R312A
      IF(M312.GT.TIME1.AND.M312.LE.TIME3)C312=((M312-TIME1)*R312B)
     -+(TIME1*R312A)
      IF(M312.GT.TIME3.AND.M312.LE.TIME4)C312=((M312-TIME3)*R312C)
     -+(TIME2*R312B)+(TIME1*R312A)
      IF(M312.GT.TIME4)C312=((M312-TIME4)*R312D)+(TIME3*R312C)
     -+(TIME2*R312B)+(TIME1*R312A)
C*****************************************************************
C*****************************************************************
C*****COST CALCULATICN FOR EVENING RATE PERIOD CALLS*****************
C***************TO NCN-NETWORK CITIES*********************************
C
      IF(M322.LE.TIME1)C322=M322*R322A
      IF(M322.GT.TIME1.AND.M322.LE.TIME3)C322=((M322-TIME1)*R322B)
     -+(TIME1*R322A)
      IF(M322.GT.TIME3.AND.M322.LE.TIME4)C322=((M322-TIME3)*R322C)
     -+(TIME2*R322B)+(TIME1*R322A)
      IF(M322.GT.TIME4)C322=((M322-TIME4)*R322D)+(TIME3*R322C)
     -+(TIME2*R322B)+(TIME1*R322A)
C*****************************************************************
C*****************************************************************
C*****COST CALCULATICN FOR NIGHT AND WEEKEND RATE PERIOD CALLS**********
C****************TO NON-NETWORK CITIES********************************
C
      C332=M332*R332
C*****************************************************************
C*****************************************************************
C*****************************************************************
C*****COST CALCULATONS FOR ALASKA OR HAWAII NON-NETWCRK CALLS
C
      DO 10 I=1,4
         M313=MIN313(I)/NLINES
         M323=MIN323(I)/NLINES
```

```
          M333=MIN333(I)/NLINES
C
C       THE FOLLOWING <IF> STATEMENTS DEFINE THE RATES TO BE USED IN THE
C       CALCULATION BASED ON THE VALUE OF I IN DO 10.
C
          IF(I.EQ.1)THEN;R313A=.3993;R313B=.3553;R313C=.3115;
       R313D=.2635;R323A=.2595;R323B=.2310;R323C=.2025;R323D=.1713;
       R333=.1398;END IF
          IF(I.EQ.2)THEN;R313A=.4303;R313B=.3830;R313C=.3357;
       R313D=.2840;R323A=.2797;R323B=.2490;R323C=.2182;R323D=.1847;
       R333=.1507;END IF
          IF(I.EQ.3)THEN;R313A=.4493;R313B=.3998;R313C=.3505;
       R313D=.2965;R323A=.2920;R323B=.2598;R323C=.2278;R323D=.1927;
       R333=.1573;END IF
          IF(I.EQ.4)THEN;R313A=.4840;R313B=.4308;R313C=.3775;
       R313D=.3195;R323A=.3147;R323B=.2800;R323C=.2453;R323D=.2077;
       R333=.1693;END IF
C*************************************************************************
C*************************************************************************
C*****COST CALCULATION FOR DAY RATE PERIOD CALLS**************************
C*******TO ALASKA OR HAWAII NON-NETWORK CITIES****************************
C
       IF(M313.LE.TIME1)C313=M313*R313A
       IF(M313.GT.TIME1.AND.M313.LE.TIME3)C313=((M313-TIME1)*R313B)
      -+(TIME1*R313A)
       IF(M313.GT.TIME3.AND.M313.LE.TIME4)C313=((M313-TIME3)
      -*R313C)
      -+(TIME2*R313B)+(TIME1*R313A)
       IF(M313.GT.TIME4)C313=((M313-TIME4)*R313D)+(TIME3*R313C)
      -+(TIME2*R313B)+(TIME1*R313A)
C*************************************************************************
C*************************************************************************
C*****COST CALCULATION FOR EVENING RATE PERIOD CALLS**********************
C*********TO ALASKA OR HAWAII NON-NETWORK CITIES**************************
C
       IF(M323.LE.TIME1)C323=M323*R323A
       IF(M323.GT.TIME1.AND.M323.LE.TIME3)C323=((M323-TIME1)*R323B)
      -+(TIME1*R323A)
       IF(M323.GT.TIME3.AND.M323.LE.TIME4)C323=((M323-TIME3)
      -*R323C)
      -+(TIME2*R323B)+(TIME1*R323A)
       IF(M323.GT.TIME4)C323=((M323-TIME4)*R323D)+(TIME3*R323C)
      -+(TIME2*R323B)+(TIME1*R323A)
C*************************************************************************
C*************************************************************************
C*****COST CALCULATION FOR NIGHT AND WEEKEND RATE PERIOD CALLS************
C***********TO ALASKA OR HAWAII NON-NETWORK CITIES**************************
C
       C333=M333*R333
C
C      SUM OF COSTS CALCULATED IN DO 10
C
       C3=C3+C313+C323+C333
10     CONTINUE
C*************************************************************************
C*************************************************************************
C*****SUM OF COSTS IN ALL RATE PERIODS, NETWORK AND NON-NETWORK***********
C
       CSUM3B=(C311+C321+C331+C312+C322+C332+C3+CMRC3B)*NLINES
C
       RETURN
       END
$ENTRY
```

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